Installation and Operation Manual
X-TMF-MfS-MFC-eng
PN 541-C-061-AAG
November, 2008

MF Smart Series

Brooks® MF Smart Series MFC/MFM

Smart Mass Flow Controller

BROOKS® INSTRUMENT

Dear Customer,

We appreciate this opportunity to service your flow measurement and control requirements with a Brooks Instrument device. Every day, flow customers all over the world turn to Brooks Instrument for solutions to their gas and liquid low-flow applications. Brooks provides an array of flow measurement and control products for various industries from biopharmaceuticals, oil and gas, fuel cell research and chemicals, to medical devices, analytical instrumentation, semiconductor manufacturing, and more.

The Brooks product you have just received is of the highest quality available, offering superior performance, reliability and value to the user. It is designed with the ever changing process conditions, accuracy requirements and hostile process environments in mind to provide you with a lifetime of dependable service.

We recommend that you read this manual in its entirety. Should you require any additional information concerning Brooks products and services, please contact your local Brooks Sales and Service Office listed on the back cover of this manual or visit www.BrooksInstrument.com

Yours sincerely,
Brooks Instrument

Essential Instructions

Read this page before proceeding!

Brooks Instrument designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you must properly install, use and maintain them to ensure they continue to operate within their normal specifications. The following instructions must be adhered to and integrated into your safety program when installing, using and maintaining Brooks Products.

- Read all instructions prior to installing, operating and servicing the product. If this instruction manual is not the correct manual, please see back cover for local sales office contact information. Save this instruction manual for future reference.
- If you do not understand any of the instructions, contact your Brooks Instrument representative for clarification.
- Follow all warnings, cautions and instructions marked on and supplied with the product.
- Inform and educate your personnel in the proper installation, operation and maintenance of the product.
- Install your equipment as specified in the installation instructions of the appropriate instruction manual and per applicable local and national codes. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, use qualified personnel to install, operate, update, program and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Brooks Instrument. Unauthorized parts and procedures can affect the product's performance and place the safe operation of your process at risk. Look-alike substitutions may result in fire, electrical hazards or improper operation.
- Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury.

Caution

This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling procedures must be observed during removal, installation or other handling of internal circuit boards or devices

Handling Procedure:

1. Power to unit must be removed.
2. Personnel must be grounded, via a wrist strap or other safe, suitable means before any printed circuit card or other internal device is installed, removed or adjusted.
3. Printed circuit cards must be transported in a conductive bag or other conductive container. Boards must not be removed from protective enclosure until immediately before installation. Removed boards must immediately be placed in protective container for transport, storage or return to factory.

Comments

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (CMOS, etc.). Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure or degraded performance.

Pressure Equipment Directive (PED)

All pressure equipment with an internal pressure greater than 0,5 bar (g) and a size larger than 25mm or 1" (inch) falls under the Pressure Equipment Directive (PED). The Directive is applicable within the European Economic Area (EU plus Norway, Iceland and Liechtenstein). Pressure equipment can be traded freely within this area once the PED has been complied with.

** Appendix 1 of this manual contains important safety and operating instructions related to the PED directive
** Meters decribed in this manual are in compliance with EN directive 97/ 23/EC module H *Conformity Assessment*.
** All Brooks Instrument flowmeters falls under Fluid-group I
** Meters larger then 25mm or 1" (inch) are in compliance with category I, II or III of the PED.
** Meters of 25mm or 1" (inch) or smaller are Sound Engineering Practice (SEP).

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Section 1: Introduction

1-1 How to use this manual.

It is recommended to read this manual before installing, operating or repairing these Mass Flow Instruments. This manual is organised into nine sections:

Section 1.	Introduction
Section 2.	Installation
Section 3.	Operation
Section 4.	Maintenance
Section 5.	Specification
Sections 6	Modellisting
Appendices	A - D

This instruction manual is intended to provide the user with all the information necessary to install, operate and maintain the Brooks MF-series Smart Mass Flow Meters and Controllers.
This series of microprocessor-based field instruments is designed to meet the rigorous demands of various industries/applications. The use of digital technology ensures that the Brooks Smart series provides maximum accuracy and signal integrity. In addition it allows easy interfacing to any peripheral equipment either through analogue or digital communication.
This manual covers Smart Mass Flow Meter models: MF60S, MF61S, MF63S and MF64S and Smart Mass Flow Controller models: MF50S, MF51S and MF53S.

Digital communication
The presence of a computer icon to the left of the text (as shown here) Denotes that the accompanying text refers to digital communication.

Smart Control
Digital communication (either via RS-232 or RS-485) allows to connect our Brooks **model 0160 Smart Control**. This interface program can be used to operate and (re)configure Smart Mass Flow Products (calibration parameters are not accessible).

Smart DDE
If you require bi-directional links between your Windows-based applications and Brooks Smart Mass Flow Products,our model **0162 Smart DDE** (a powerful, user-friendly Dynamic Data Exchange software program) offers all the features you need.

Smart Service
If you are equipped with primary standard Volumeter calibration equipment or (secondary standard) Brooks Smart Mass Flow Meters, you can use the **model 0163 Brooks Smart Service** program for (re)configuration, diagnostics, calibration and/or verification. The HART protocol-based commands are listed in a separate document: Brooks part number: **541-C-053-AAA**.
Profibus-DP Communication manual Please, refer to Profibus instruction manual partnumber 541-C-068-AAG.

1.2 Description

Models MF60S, MF61S, MF63S and MF64S Brooks MF-series Smart Mass Flow Meters are primarily used to provide accurate measurements of gas flows. The heart of these systems is the thermal mass flow sensor, which produces an electrical output signal as a function of flow rate.
In addition, models MF50S, MF51S and MF53S Brooks MF-series Smart Mass Flow Controllers control gas flows. The flow ranges per model are listed in Table 1-1.

Table 1-1: Flow ranges per model.

Mass Flow	Mass Flow	Flow Ranges		
		Controller	Meter	
Model:	Model:	min. f.s.	max. f.s.	Unit *
MF50 S	MF60 S	0.00	30	ln/min.
MF51 S	MF61 S	20	100	ln/min.
MF53 S	MF63 S	100	2500	ln/min
	MF64 S	18	2160	m³n/h

** refers to 'normal' conditions, i.e. 0°C, 1013.25 mbar.*

The Brooks MF-series Smart Mass Flow Meter is a stand-alone instrument with microprocessor-based electronics on board. The MF-series Smart Mass Flow Controller has an integrally-mounted control-valve module with which table gas flows can be achieved.

MASS FLOW METERS

- The supplied inlet adapter has a built-in, upstream inlet filter for flow straightening. Besides reducing the effects of changes in upstream piping, this also protects the measuring element from occasional debris in the flow stream. In addition, it eliminates the need for extra (expensive) inlet filtering.
- Flow signal adjustable via software: (not for Profibus)
  0-5 Vdc or
  1-5 Vdc or
  0-20 mA or
  4-20 mA
- Output damping provides a constant scale reading under fluctuating flow rate conditions. Standard factory setting: 0.5 sec. (not for Profibus)
- Output limiting prevents possible damage to delicate acquisition devices by limiting the output to 0-5.25 Vdc on the voltage signal output and 0-21 mA on the current output. (not for Profibus)
- An alarm (TTL open collector) signal output is available to the user. If the instrument's specifications are exceeded, either by process conditions or by the device itself, an alarm signal can be generated.

Note:
Digital output (communication) is simultaneously available with analogue output (not for Profibus).

MASS FLOW CONTROLLER
Standard features include:

- The supplied inlet adapter has a built-in, upstream inlet filter for flow straightening. Besides reducing the effects of changes in upstream piping, this also protects the measuring element from occasional debris in the flow stream. In addition, it eliminates the need for extra (expensive) inlet filtering.
- Each MF-series Smart Mass Flow Controller is provided with an adaptive valve-control algorithm for the maintenance of stable flow control, even under varying process conditions (pressure/temperature).
- Setpoint source selectable: Setpoint signal source for the Mass Flow Controller can be selected from: (not for Profibus)
  communication (RS232 / RS485) or
  0-5 Vdc or
  1-5 Vdc or
  0-20 mA or
  4-20 mA.
- Fast Response Control provides rapid gas settling times with minimal over/ undershoot. Standard factory setting: 1 sec. for MF50/51 and meter models, 3 sec. for MF53.
- Valve Override (VOR, available at pin 12) allows the user to fully open or close the control valve independently of the set-point.
- Low flow cutoff prevents the valve from opening whenever the Set point is less than 1% of full scale.

ALL MODELS
Digital communication features
Digital communication, via RS485 or RS232, provides access to all of the Smart TMF's functions, including:

- Accurate mass flow measurement and Set point regulation (controller only), as a percentage of full scale and in selectable engineering units
- Flow totalizer
- Ambient temperature
- Operational settings
  ⇒ Calibration (storage of up to 10 calibration curves)
  ⇒ Controller settings (controller only)
  - PID settings
  - Selectable soft start
  - Adaptive valve control
  ⇒ Adaptive filtering for signal flow component

- Alarms
  ⇒ Self-diagnostic
  EEPROM error
  - Database error
  - Analogue output error
  ⇒ Out-of-range indications for
  - Analogue set points higher than 100% (controller only)
  - Flow
  - Valve (controller only)
  - Analogue output

⇒ Environmental errors
- No gas flow detected
- Power supply outside specification range
- Ambient temperature outside specified range high and low flow alarms

- Digital communication, via Profibus-DP referring to document 541-C-068-AAG

Section 2: Installation

2-1 General

This section contains the procedures for the receipt and installation of the instrument. See Section 1 for dimensional and connection requirements. Do not attempt to start the system until the instrument has been permanently installed. It is important that the start-up procedures be followed in the exact sequence presented.

2-2 Receipt of Equipment

When the instrument is received, the outside packing case should be checked for damage incurred during shipment. If the packing case is damaged, the local carrier should be notified at once regarding his liability.
A report should be submitted to your nearest Product Service Department.

Brooks Instrument
407 W. Vine Street
P.O. Box 903
Hatfield, PA 19440 USA
Toll Free (888) 554-FLOW (3569)
Tel (215) 362-3700
Fax (215) 362-3745
E-mail: BrooksAm@BrooksInstrument.com
www.BrooksInstrument.com

Brooks Instrument
Neonstraat 3 1-4-4
6718 WX Ede, Netherlands
P.O. Box 428
6710 BK Ede, Netherlands
Tel 31-318-549-300
Fax 31-318-549-309
E-mail: BrooksEu@BrooksInstrument.com

Brooks Instrument
Kitasuna Koto-Ku
Tokyo, 136-0073 Japan
Tel 011-81-3-5633-7100
Fax 011-81-3-5633-7101
Email: BrooksAs@BrooksInstrument.com

Remove the envelope containing the packing list. Carefully remove the instrument from the packing case. Make sure spare parts are not discarded with the packing materials. Inspect for damaged or missing parts.

2-3 Recommended Storage Practice

If intermediate or long-term storage of equipment is required, it is recommended that the equipment be stored in accordance with the following conditions:

a. Within the original shipping container.
b. Stored in a sheltered area, preferably a warm, dry, heated warehouse.
c. Ambient temperature 21°C (70°F) nominal, 32°C (90°F) maximum, 45°F (7°C) minimum.
d. Relative humidity 45% nominal, 60% maximum, 25% minimum.

2-4 Return Shipment

Prior to returning any instrument to the factory visit the Brooks website www.BrooksInstrument.com for a Return Materials Authorization Number (RMA#), or contact one of the following locations:

Brooks Instrument
407 W. Vine Street
P.O. Box 903
Hatfield, PA 19440 USA
Toll Free (888) 554-FLOW (3569)
Tel (215) 362-3700
Fax (215) 362-3745
E-mail: BrooksAm@BrooksInstrument.com
www.BrooksInstrument.com

Brooks Instrument
Neonstraat 3 1-4-4
6718 WX Ede, Netherlands
P.O. Box 428
6710 BK Ede, Netherlands
Tel 31-318-549-300
Fax 31-318-549-309
E-mail: BrooksEu@BrooksInstrument.com

Brooks Instrument
Kitasuna Koto-Ku
Tokyo, 136-0073 Japan
Tel 011-81-3-5633-7100
Fax 011-81-3-5633-7101
Email: BrooksAs@BrooksInstrument.com

⚠WARNING

Before returning the device purge thoroughly with a dry inert gas such as Nitrogen before disconnecting gas connections. Failure to correctly purge the instrument could result in fire, explosion or death. Corrosion or contamination may occur upon expo ure to air.

All flow instruments returned to Brooks requires completion of Form RPR003-1, Brooks Instrument Decontamination Statement, along with a Material Safety Data Sheet (MSDS) for the fluid(s) used in the instrument.
Failure to provide this information will delay processing by Brooks personnel. Copies of these forms can be downloaded from the Brooks website www.BrooksInstrument.com or are available from any Brooks Instrument location listed above.

2.5 Gas connections

All models are fitted with the following inlet and outlet connectors as standard: NPT(F), tube compression fittings, VCR, VCO, DIN or ANSI flanges. Prior to installation, make certain that all piping is clean and free of obstruction. Install the piping in a manner that permits easy access to the instrument, should it need to be removed for cleaning or test-bench troubleshooting.

2.6 Mechanical Installation

(For dimensional drawings see Appendix B: Dimensional drawings)

NOTE: When installing the Mass Flow device, care should be taken to prevent foreign materials from entering the instrument's inlet or outlet. Do not remove the protective end-caps until the actual moment of installation.
When used with reactive gases (some of which may be toxic), contamination or corrosion may occur as a result of plumbing leaks or improper purging. Plumbing should be purged (for a significant time) with Nitrogen before and after use on reactive gasses.

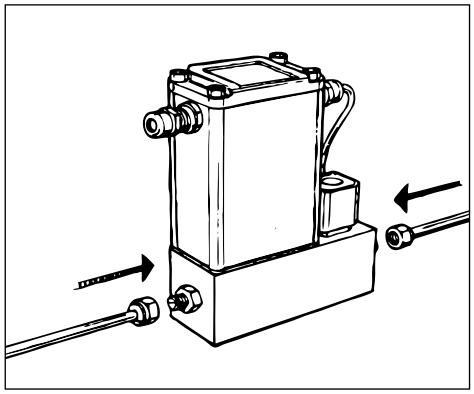


Figure 2-1: Mechanical installation

Recommended installation procedures:

a. All models should be mounted in places that are relatively free from mechanical shocks and vibration.
b. Leave sufficient room for access to the electrical components.
c. Install in a manner that allows the instrument to be easily removed for cleaning.
d. The mounting position of the Smart Mass Flow Meter or Controller can be either horizontal or vertical, in case process pressures are smaller than 10 bar.
e. For higher process pressures, a horizontal installation is preferred, since these pressures may cause a thermal siphon effect of the output signal at zero flow conditions and degrading specifications.

NOTE: The control valve of the MF-series Smart Mass Flow Controller provides precision control and is not designed for positive shut off. If positive shut off is required, it is recommended that a separate shut-off valve be installed in-line, downstream from the MF-series Smart Mass Flow Controller**.**

NOTE: If the power supply to the MF-series Smart Mass Flow Controller is interrupted, a NORMALLY CLOSED valve will be fully closed, while a NORMALLY OPEN valve will be fully open. The NORMALLY OPEN control valve meets application specific requirements, since it allows nitrogen gas purging if the power supply is interrupted.

2.7 In-Line Filter

An in-line filter is installed, as standard, in the instrument's inlet to prevent any foreign material entering the flow sensor or control valve. The filtering element should be periodically replaced or ultrasonically cleaned. Apply only clean gasses on Mass Flow Meter / Controllers.

2.8 Electrical Interfacing (not for Profibus)

The installation of Smart TMF involves connecting to terminal strips. For details of correct installation, see figure 2-2 and Table 2-2, 2-3 and 2-4.

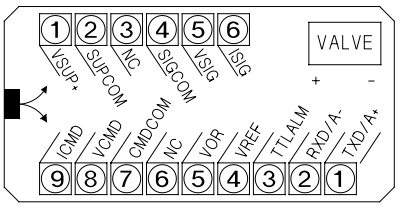


Figure 2-2: Electrical compartment

Table 2-1: Pin configuration

PIN NO:	FUNCTION
1	VSUP +
2	SUPCOM
3	NC
4	SIGCOM
5	VSIG
6	ISIG
1	TxD / A+
2	RxD / A-
3	TTLALM
4	VREF
5	VOR
6	NC
7	CMDCOM
8	VCMD
9	ICMD

Table 2-2: Electrical connection 9-pins terminal

pin	*	Function	Controller	Meter
1	TxD/A+	RS-232/RS-485 TxD/A+	•	•
2	RxD/A-	RS-232/RS-485 RxD/A-	•	•
3	TTLALM	(TTL) Open collector alarm output	•	•
4	VREF	+5 Vdc ref. output	•	•
5	VOR	Valve override input	•	n.a.
6	NC	Not connected	•	•
7	CMDCOM	Setpoint return (-)	•	n.a.
8	VCMD	0 (1)-5 Vdc Setpoint input (+)	•	n.a.
9	ICMD	0 (4)-20 mA Setpoint input (+)	•	n.a.

* *Abbreviation for the function description can be found under the top cover*

Digital communication (pins 1 and 2)
(pins 1 and 2) are available for connecting the device to the TxD/A+ or RxD/A-lines for RS-232/RS-485 communications.

NOTE: Either RS-232 or RS-485 should be specified at the time of ordering. See section 2.7 for details of how to configure the p.c. board.

Alarm (pin 3)
A (TTL) Open Collector alarm output is available.
Type of used transistor is NPN.

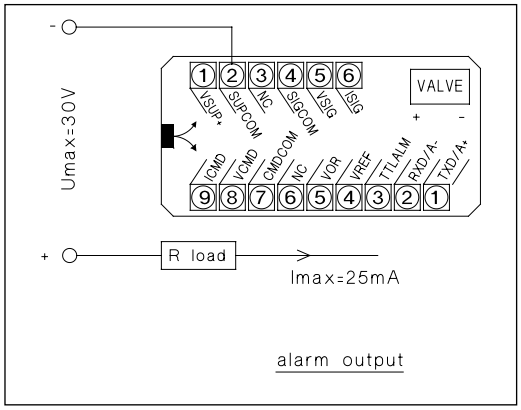


Figure 2-3: Open Collector

5 Vdc reference (pin 4)
A +5 Vdc ref. voltage is available on (pin 4). This can be used to set the Set point with the aid of an externally locate potentiometer (10 turn 2 KOhm suggested).

Valve override (pin 5 Controller models only)
To open or close the control valve independently of the Set point signal (e.g. for safety reasons), (pin 5) is available to carry a valve override signal. Leave floating (i.e. not connected) to allow for normal control operation.

≥ 5 Vdc	➡	Valve Open
≤ 0 Vdc	➡	Valve losed

NOTE: The valve override command on pin 5 takes precedence over the communication-mediated valve override command.

Analogue Setpoint Input (pins 7, 8 or 9; Controller models only)
The MF-series Smart Mass Flow Controller can be used either with a current or voltage Set point. To use the current Set point, connect the Set point signal to (pin 9) and the Set point return signal to (pin 7) on the terminal (jumper J1 must be in place refer to Figure 2-6). To use the voltage Set point, connect the Set point signal to (pin 8) and the Set point return to (pin 7).

Power Supply (pins 1 and 2)
The power supply is connected via (pin 1) (+15 to +28 Vdc) and (pin 2) (power supply common).

Table 2-3: Electrical connection 9-pins terminal

pin	*	Function	Controller	Meter
1	VSUP+	15 Vdc to +28 Vdc Power supply	•	•
2	SUPCOM	Power supply common	•	•
3	NC	Reserved	n.a	n.a
4	SIGCOM	Flow signal output common	•	•
5	VSIG	0 (1)-5 Vdc Flow signal output	•	•
6	ISIG	0 (4)-20 mA Flow signal output	•	•

** Abbreviation for the function description can be found under the top cover*

Signal Output (pins 4,5 and 6)
(Pin 4 and 5) indicates the flow rate, represented by a 0-5 Vdc or 1-5 Vdc signal proportional to the mass flow. (Pin 4 and 6) indicates the flow rate, represented by either a 0-20 mA or 4-20 mA signal current proportional to the mass flow. Both the current and voltage signals are returned via (pin 4)

NOTE: I/O configuration to be defined at time of ordering. Reconfiguration at customer side can be accomplished using digital communication.

NOTE: With regard to the power supply connections, the attached cable must be as short as possible to ensure that the minimum required voltage and current is available at the mass flow device.

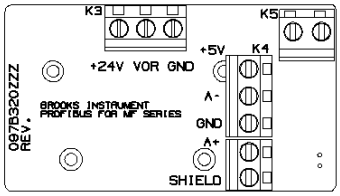
Cable Shielding Earth
Cable requirements
Compliance with EMC directive 89/336/EEC, requires that the equipment be fitted with fully screened signal cables with at least 80% shielding. The cable shielding should be connected to the PG connector's metal shell, and have 360° shielding at both ends. The shielding should be connected to an earth terminal.

For translations of this instruction, see Appendix D: Translations of CE Marking electrical installation instructions.

2.9 Electrical interfacing Profibus MF

2.9.1 Main connector (MF series)

The MF series have a PG11 connector at the inlet side of the mass flow device for the power supply and analogue I/O. In case of profibus no analogue I/O is possible, except for the Valve OverRide (VOR) input. In these cases this PG11 connector is solely used for the power supply connection and the VOR input signal. Figure 2-4 shows the terminal connection location for power supply and V.O.R. the power connection (as well as the profibus connection terminals) can be acces-seal by opening the top cover plate by removing the four polts on the top of the cover plate.
The minimum requirement to operate the device on a Profibus network is the connection of the power supply lines, labeled +24V and GND.



Main power connection (K3)	
+24 Vdc	24V
VOR (Valve Override)	VOR
Power supply common	GND

Figure 2-4: MF Profibus Main Power Connection

The valve override signal, middle screw terminal labeled VOR, can always be used in parallel to the network. The command (OPEN,or CLOSE) issued through this VOR terminal always takes precedence over the network valve override command. If the level on this terminal is left floating (not connected) a valve override command issued through the network will be carried out.

NOTE: With regard to the power supply connections, the attached cable must be as short as possible to ensure that the minimum required voltage and current is available at the mass flow device.

Cable Shielding Earth

Cable requirements
Complaince with EMC directive 89/336/EEC, requires that the equipment be fitted with fully screened cables with at least 80% shielding. The cables with at least 80% shielding. The cable shielding should be connected to the PG connector's metal shell, and have 360 shielding at both ends. The shielding should be connected to an earth terminal.
For translations of this instruction, see Appendix D of the MF series Instruction and Operation manual p.n. #541-C-061-AAG: Translations of installation instructions.

2.9.2 Profibus connector (MF series)

The Profibus-DP electronics is hooked up via a separate M12 connector on top of the device. This connector has IP65 protection rate and is defined in the Profibus guideline 2.142: Interconnection Technology Sepecifictions. This allows for the use of standards available, Profibus approved network connectors, enabling fast and easy connection of a Profibus network Figure 3-4 below shows the pin numbering. The connector provides the four mandatory signals as defined in the EN 50170, i.e. RxD/TxD-P, RxD/TxD-N, VP and DGND. The Profibus signals are galvanic isolated from the main electronics. The fifth (5) connector terminal is the shieldings.

Screw connector	Profibus connector pinning	Function	Color
1	1	P5V	Brown
2	2	A-lin	Green
3	3	Gnd	Blue
4	4	B-line	Red
5	5	Shield	Grey

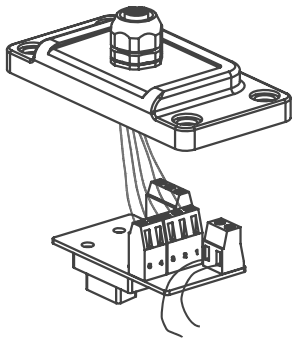


Figure 2-5: Pinnumbering

2.10 Digital Communication

NOTE: The printed circuit boards only need to be reconfigured if the hardware settings differ from those specified at the time of ordering.

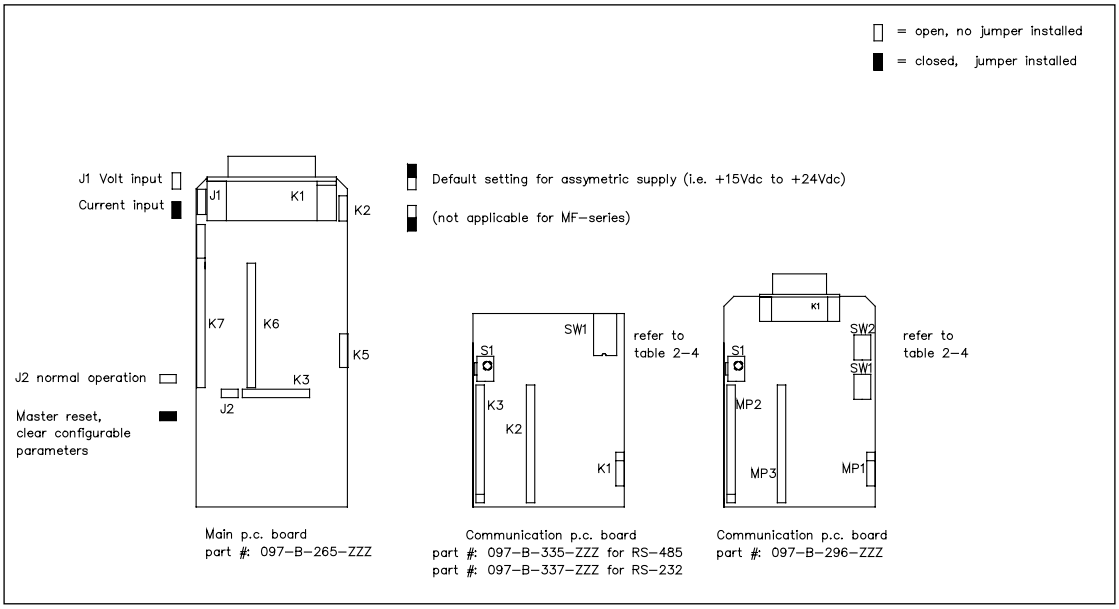


Figure 2-6: p.c. boards with the locations of jumper switches. note: Switch number 1 is the lowest switch of four (4)

Brooks MF-series Smart Mass Flow Meters and Controllers incorporate two printed circuit boards: one main board containing the processor and a piggyback board. The piggyback board enables the device to communicate with a PC via an RS-232 or RS-485 connection. The piggyback board is installed via the K5, K6 and K7 connectors on the main board (see Figure 2-6).

The digital communication piggyback board is used for all communication-related hardware settings. For this purpose, the board is equipped with a dipswitch block (SW1) holding 4 switches. RS-232 Board (097-B-364-ZZZ) or RS-485 Board (097-B-363-ZZZ), and to select the baud rate. Table 2-4 summarizes the possible settings.

For (dis) assembly of the top cover and or housing refer to section 4.6.

Table 2-4: Dipswitch settings (not for Profibus

Physical Layer selection RS-232 RS-485	Baud rate selection		Dipswitch block SW1		
		Switch #1 Off / On	Switch #2	Switch #3	Switch #4
	1200		Off	Off	Off
	2400		On	Off	Off
	3600*		Off	On	Off
	4800		On	On	Off
	7200*		Off	Off	On
	9600		On	Off	On
	19200		Off	On	On
	38400*		On	On	On

* not supported by Windows

Since Brooks MF-series Smart Mass Flow devices are capable of communication immediately after start-up, you should set the correct baud rates prior to power up. Any changes to the baud rate settings or the physical layer selection made during operation will take effect immediately. The communication I/O drivers are directly connected to the terminal strip on top of the device.

The RS-232 is essentially a point-to-point connection, i.e. one host-computer and one Smart Mass Flow device. Most IBM-compatible PCs are equipped with one or more RS-232 ports (COM ports) as standard. The RS 232 usage and definitions are very diverse. On the MF Smart Mass Flow device the TXD signal is the output signal of the device and the RxD the input signal. The communication terminals can be directly connected to a serial COM-port of any PC. The other part of the terminals can be connected to Brooks model 0152/0154 Microprocessor-based Readout and Control Electronics. Or power supply only. This model provides the power supply for Smart Mass Flow devices, as well as providing local readout and displaying the analogue output signals. Figure 2-7 shows the interconnection diagram of the RS-232 configuration. The pin assignment on an IBM Compatible PC. This is standard for RS-232.

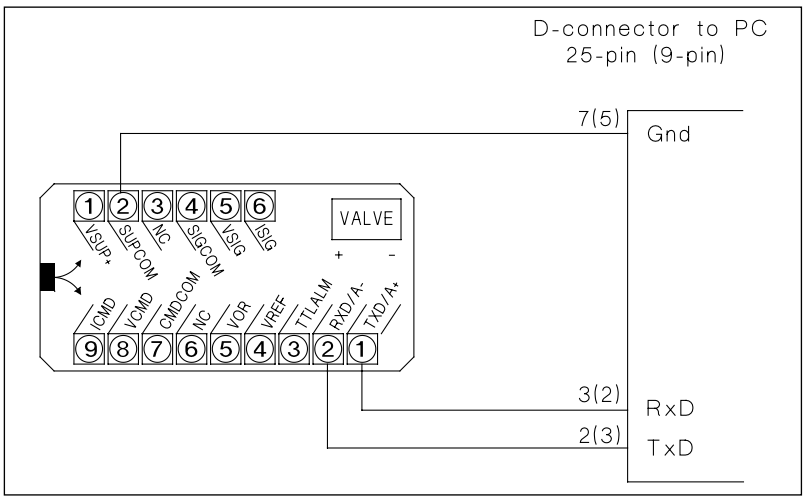


Figure 2-7: RS-232 interconnection of TMFs and PC (not for Profibus)

The RS-485 is essentially a multidrop connection. It allows a maximum of 32 devices to be connected to a computer system. IBM-compatible PCs are not equipped with RS-485 ports as standard. An RS-232 to RS-485 converter or RS-485 interface board is therefore required to connect an RS-485 to a standard PC. Figure 2-8 is an interconnection diagram showing two MFs linked to an IBM-compatible PC, via RS-485 and RS-485 to RS-232 converter. The RS-485 bus requires two resistors of 120, one at the end of the bus and one at the beginning, near the converter depending on the convertor, the resistor may already be installed internally in the converter. The RS-485 bus also requires a daisy-chain network, meaning that the wires are connected as showed in figure2-8.

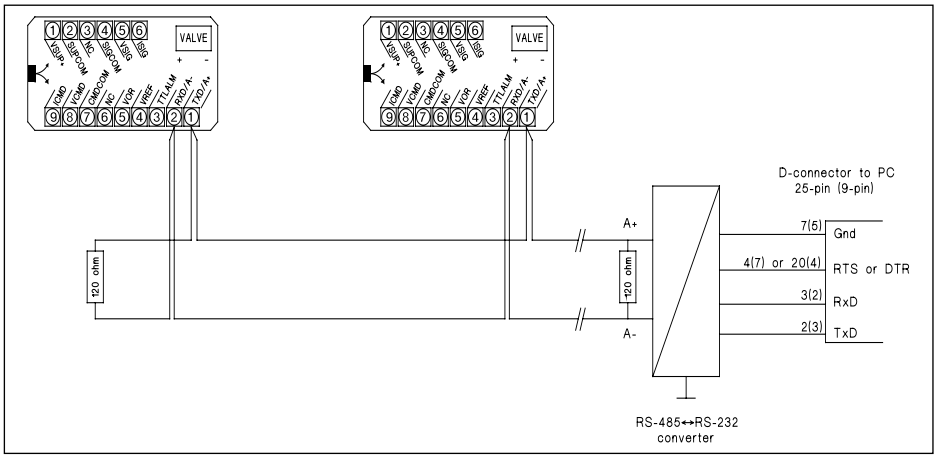


Figure 2-8: RS-485 multidrop interconnection TMFs and PC

2.11 Interconnection with Peripheral Equipment

For Profibus communication cable and connectors as specified in Profibus guideline “Profibus interconnection guidelines” document 2.142 for further details refer to Profibus instruction manual.

2.12 Interconnection

A shielded cable must be used for interconnection between the device and the pheripheral equipment. All relevant connections can be made via the terminal strips. The shielding of the cable must be grounded via the cable gland: please refer to appendix C for detailed instructions.

Section 3: Operation

3.1 Operating Procedure

1. Apply power to the Mass Flow device and allow approximately 45 minutes for the instrument to reach a stable temperature.
2. Check the flow reading before turning on the pressurised gas supply. If the flow reading is >0.2% then the instrument should be re-zeroed (see section 3.2).
3. Turn on the gas supply.
4. Regulate flow to 0%. Monitor the instrument's output signal. If the output is not <0.2%, check for leaks.
5. Commence normal operation.

3.2 Zero Adjustment

Each Smart Mass Flow device is factory-adjusted to provide a 0 ±10 mVdc signal at zero flow. The adjustment is carried out in our calibration laboratory, an ambient the temperature of 20°C is maintained. After initial installation and warm-up in the gas system, the zero flow indication may differ from the factory setting. This is primarily caused by differences in temperature between our calibration laboratory and the final mounting position.
When checking the zero flow indication, always mount the device in its final location and allow a minimum of 45 minutes for it to reach a stable temperature.
In case Zero adjustment is required, this can be done via Smart Control; model 0160.

3.3 Calibration Procedure

Calibration of the Smart MF is not described in this manual. Calibration can only be achieved with use of the accurate Brooks Volumeter equipment and the Smart Service software model; 0163 (see paragraph 4.4).

Section 4: Maintenance

4.1 General

No routine maintenance is required on the MF-series Smart Mass Flow Meters and Controllers other than occasional cleaning. The in-line filter should periodically be replaced or ultrasonically cleaned.

NOTE: If recalibration is required, but the necessary expertise or equipment is not available, the instrument should be returned to the factory.

4.2 Troubleshooting

System checks
The MF-series Smart Mass Flow Meters and Controllers are generally used as a component in gas handling systems, which can be complex in nature. It can therefore be very difficult to isolate a malfunction in the system. An incorrectly diagnosed malfunction can cause many hours of unnecessary downtime. If possible, perform the following system checks before removing a suspect Mass Flow Meter or controller for bench troubleshooting or return to the factory (especially if the system is new):

1. Verify a low resistance common connection and that the correct power supply voltage and signals are present of the connector of the MF-series Smart TMF.
2. Verify that the process gas connections have been made correctly, and that they have been tested for leaks.
3. If the mass flow controller appears to be functioning but cannot achieve Set point, verify that there is sufficient inlet pressure and pressure drop at the controller to provide the required flow.
4. Verify that all user-selectable jumpers and switches have been set to the appropriate positions. Refer to Figure 2-4 and table 2-4.

NOTE: If it becomes necessary to remove the instrument from the system after exposure to toxic, pyrophoric, flammable or corrosive gas, purge the instrument thoroughly with a dry inert gas such as nitrogen before disconnecting the gas connections. Failure to correctly purge the instrument could result in fire, explosion or death. The MF-series Smart Mass Flow device may also become corroded or contaminated upon exposure to air.

Table 4-1: Bench Troubleshooting

Trouble	Possible Cause	Check/Corrective Action
Output stays at zero (regardless of Set point) and there is flow through the meter/controller	Clogged Sensor Defective electronic board	Clean sensor. Refer (Section 4.3).
Flow can not be achieved regardless of checkpoint. (applicabable to MFC)	Clogged Control Valve Valve override input is grounded Defective electronic board	Clean the control valve (section 4.3) or return the device to the factory Check the valve override input (pin 5 of 9 row) Contact Brooks Instrument.
Output signal stays at approx. 5.25 Vdc or 21 mA (regardless of Set point) and there is flow through the meter/controller	Valve leaks or is stuck open (applicable to MFC) +15V applied to the valve override input (applicable to MFC) Defective electronic board	Clean and/or adjust control valve (Section 4.3). Check the valve override terminal (pin 5 of 9 row) Contact Brooks Instrument.
Output signal follows Set point at higher set points but will not go below 2%	Control valve leaks or is stuck open	Clean the control valve or return the device to the factory (Section 4.3)
Output signal follows Set point at lower set points, but does not reach full scale	Insufficient inlet pressure or pressure drop Partially clogged sensor Partially clogged valve (applicable to MFC) Valve out of adjustment (applicable to MFC) Valve guide spring failure (applicable to MFC)	Adjust pressures, inspect in-line filters and clean/replace as necessary 4.2 Clean sensor, see cleaning procedures (Section 4.3) Clean the control valve (section 4.3) or return the device to the factory, see cleaning procedures Adjust valve, see calibration procedures (Section 4.4) Controller oscillates (see below)
Instrument grossly out of calibration. Flow is higher than desired	Partially clogged sensor	Clean sensor, see cleaning procedures (Section 4.3)
Instrument grossly out of calibration. Flow is lower than desired	Partially clogged restrictor	Replace or clean restrictor.
Controller oscillates (applicable to MFC)	Pressure drop or inlet pressure deviates from calibrated values Oversized orifice Valve out of adjustment Unstable inlet pressure Defective p.c. Board	Adjust pressures Check orifice size. Adjust valve, see calibration procedures (section 4.4) Check external pressure regulator Contact Brooks Instrument

Bench Troubleshooting

1. Establish a proper connection between the MF-series Smart Mass Flow Meter or Controller and a +15 Vdc to +28 Vdc power supply and connect an output signal readout device (4½ digit voltmeter recommended) to pins 5 of 6 row and 4of 6 row of the terminal strip. Switch on the power and allow the instrument to warm-up for 45 minutes. In case of a Controller model, adjust the Set point to zero. Do not connect the device to a gas source yet. Observe the output signal and, if necessary, perform the zero adjustment procedure (section 3.2). If the output signal does not zero properly, please contact Brooks Instrument.
2. Connect the instrument to a source of the same gas used for its original calibration. Regulate the Set point to 100% flow and adjust the inlet and outlet pressures to the calibration conditions. Verify that the output signal reaches 5.00 volts and stabilizes at that value. Vary the command voltage over the 1 to 100% range and verify that the output signal follows the Set point. If possible, connect a flow measurement device to monitor the actual flow behavior and verify the accuracy of the mass flow instrument. If the mass flow instrument performs as described above then it is functioning correctly and the problem may lie elsewhere.

Table 4-1 lists possible malfunctions which may be encountered during bench troubleshooting.
For controller models only: Apply +5 to the +15 Vdc valve override pin (pin 5 of 9 row) and verify the output signal falls below 2%.

4.3 Cleaning Procedures

When deposition makes it necessary to clean the MF-series Smart Mass Flow Controller or Mass Flow Meter, use the following procedures:

1. Remove the unit from the system.
2. Purge with dry nitrogen gas, which removes virtually all particulate matter from the device. Should contamination persist, subject all wetted[1] components to ultrasonic cleaning. Following this, purge the device thoroughly with dry nitrogen once again.
3. If the sensor is contaminated, remove the sensor and use a hemostat or tweezers to push a 0.007”-diameter piano wire through the flow-sensor tube to remove any contamination (end closest to the control valve). The sensor tube can then be flushed with a solvent that leaves no residue. This can be accomplished conveniently using a hypodermic needle filled with solvent.

NOTE: Do not soak the sensor assembly in a cleaning solution. If solvent seeps into the sensor assembly, it will probably damage the sensor, or at least significantly alter its operating characteristics.

4.4 Calibration Procedure

The calibration of MF-series Smart Mass Flow devices is not described in this manual. Such calibration requires the use of accurate and traceable calibration equipment such as Brooks Volumeter equipment, in addition Smart Service software model 0163 is needed.

1. Wetted components include the body, laminar-flow element and all valve components including the orifice, process adapters and inlet filter.

However, if the above equipment is available at your facility, then Brooks Instrument will supply you with copy of the calibration procedure document (no.:834-P-088-AAG) upon request.

4.5 Valve (Dis)Assembly Procedure

NOTE: If (dis)assembly is required, but the necessary expertise or equipment is not available, then the instrument should be returned to the factory.

However, if the requisite equipment is available at your facility, Brooks Instrument will supply you with copy of the valve (dis)assembly procedure document (no.: 834-L-030-AAG) upon request.
The model MF53S control valve assembly consists of an axially mounted main valve driven by the top-mounted pilot valve. The main valve should not be disassembled. If necessary, please return the Mass Flow Controller to the factory.

4.6 Housing (Dis)Assembly Procedure

In the event that it is required to adjust the hardware settings in the main or digital board (I.e. jumper settings or switches) the following tools are needed:
1) 1/4” Hex screw for removal of the top cover
2) 3mm Hex screw (130 mm long shaft) for removal of the housing

Section 5: Specification

PERFORMANCE SPECIFICATIONS

Flow Accuracy	± 0.7% of rate and ±0.2% f.s. at calibration conditions or ± 0.5% of rate and ±0.1% f.s. at calibration conditions on request ± 1% f.s. for model MF63/53 above 1100 ln/min.
Repeatability	± 0.25% of rate
Rangeability	50:1 (within specified accuracy)
Controllability	100:1 (i.e. total operating range)
Stability	Less than ± 0.5% of rate per year
Temperature Effect (after re-zeroing)	Less than 0.015%/°C of rate shift from original Calibration over 0 - 70°C. For flowrates over 100 l/min gas and ambient temperatures must be equal.

PHYSICAL SPECIFICATIONS

Materials of Construction	Wetted parts stainless steel with Viton®, Buna-N®, PTFE/Kalrez® or EPDM seals
Mechanical Connections	NPT(F), Tube compression, VCR and VCO Option: Flanged DIN- or ANSI type available
Electrical Connections	Terminal strip, accessible via PG 11cable gland. Or fixed cable with flying leads.

SPECIFICATIONS

Certification

* EMC Directive (89/336/EEC)
EN 61326-1: 1997 + A1: 1998

* ATEX Directive (94/9/EC)
KEMA 98ATEX4887 X - Type n Certificate
EN 50021: 1999
EN 50281-1-1: 1998 +A1

* Pressure Equipment Directive (97/23/EC)

*UL and cUL listed with 1/2 inch NPTF or M20 x 1.5mm conduit connector for: Class I Division 2 Groups A,B,C,D and Class II Division 2, Groups F and G and Class III Class I Zone 2 Group IIC, IIB, IIA T3C,
Ambient/gas temperature 40°F - 150°F (5°C - 65 °C) Class 2
Power Supply, 28 Vdc max., 370 mA for controllers and 90 mA for meters

* UL and cUL recognized with Pg11 or M20x1.5 cable gland for: Class I Division 2, Groups A,B,C,D and Class II Division 2, Groups F and G and Class III Class I Zone 2 Group IIC, IIB, IIA T3C, Ambient/ gas temperature 40°F - 150°F (5°C - 65°C) Class 2 Power Supply, 28 Vdc max., 370 mA for controllers and 90 mA for meters.

Protection Grade IP 65 and NEM

Table 5-1: Flow ranges and pressure rating

Brooks Smart Mass Flow Products						
Mass Flow Controller	Mass Flow Meter		Flow Ranges N2 Equivalent		Pressure Ratings	P.E.D. Module H Category
Model:	Model:	Min. f.s.	Max. f.s.	Unit [1]	Bar	
MF50 S	MF60 S [2]	0.003	30	l_n/min.	100 bar	S.E.P.
MF51 S	MF61 S	20	100	l_n/min.	100 bar	S.E.P.
MF53 S	MF63 S	100	2500	l_n/min.	70 bar	1 for all 150 lbs flanges 2 for all other connections
	MF64 S	18	2160	m^3_n/h		See pressure matrix Table 5-2
1) referring to normal conditions, i.e. 0°C 1013.25 mbar *2) MF60 can be used at 300 bar*						

Setpoint Input * (not for Profibus)	Voltage:	0 - 5 Vdc or 1 - 5 Vdc input
	impedance	> 2000 Ohm
	or Current:	0 - 20 mA or 4-20 mA
		250 Ohm impedance
Analogue Outputs* (not for Profibus)	Voltage:	0 - 5 Vdc or 1 - 5 Vdc
		> 2000 Ohm
	and Current:	0-20 mA or 4-20 mA
		Max. loop resistance 375 Ohm.
Digital Communication*	RS-232 or RS-485*	
	Baud rate 1200, 2400, 3600, 4800, 7200, 9600, 9K2, 38K4* (Default: RS-232, Baudrate 9600)	
	Profibus DP*	
Alarm	If self-diagnostics detect a fallure, the alarm mode will be Analogue activated. (TTL) Open Collector output, signal grounded when activated. Max. 30 Vdc, 25 mA. (not for Profibus) Or via communication port, when used digitally.	
5 Vdc ref. (not for Profibus)	5 Vdc reference voltage load impedance >2000 Ohm	

* To be specified at ordering

Power requirements	+15Vdc to +28Vdc (use only 24 Vdc for NO valves and for use of MF51) +24Vdc only for all Profibus units
Power Consumption Mass Flow Meters	Models MF60 S, MF61 S, MF63 S and MF64 S for + 24 Vdc (± 10%) at 80 mA for + 15 Vdc (± 5%) at 90 mA Also applicable for Profibus
Power Consumption Mass Flow Controllers	Models MF50 S, MF51 S and MF53 S for + 24 Vdc (± 10%) at 140 mA for + 15 Vdc (± 10%) at 185 mA Also applicable for Profibus **NOTE:** With valve override function activated: the total power consumption specifications are: for + 15 Vdc at 285 mA or for + 24 Vdc at 370 mA Also applicable for Profibus
Temperature	Both ambient and process gas: 0-70 °C.
Leak Integrity	Outboard: 1 x 10^{-9} mbar l/sec. Helium
Security	To prevent “unauthorized” setting or reranging of span or zero, these functions are only accessible via the Brooks Smart Control, model 0160, or using Smart DDE, model 0162.
Warm-up time	< 10 minutes; 1% F.S. accuracy. Performance within specifications: 45 minutes.
Damping (not for Profibus)	Damping from 0 to 10 seconds is possible for the flow output signal (default setting is 0.5 sec.)
Response (Meters)	Standard response of the flow output signal 1 sec. Response of better than 0.2 seconds on request.
Settling Time (Controllers)	Standard 1 sec. Settling time or up to 0.2 seconds is possible (to within 2% full scale of final value) for any command (Set point) step; virtually without any dead time, over- or undershoot. Model MF53S 3 sec. (1 sec. on request).

KEMA

(1) # TYPE EXAMINATION CERTIFICATE

(2) Equipment and protective systems intended for use in potentially explosive atmospheres - Directive 94/9/EC

(3) Type Examination Certificate Number: **KEMA 98ATEX4887 X** Issue Number: **4**

(4) Equipment: **Smart Mass Flow Controller Type MF50, MF51 and MF53**
Smart Mass Flow Meter Type MF60, MF61, MF63 and MF64

(5) Manufacturer: **Brooks Instrument LLC**

(6) Address: **407 West Vine Street, Hatfield, PA 19440, USA**

(7) This equipment and any acceptable variation thereto is specified in the schedule to this certificate and the documents therein referred to.

(8) KEMA Quality B.V. certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the directive.

The examination and test results are recorded in confidential test report no. 2113693-14.

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 60079-15 : 2003 **EN 50281-1-1 : 1998 + A1**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This Type Examination Certificate relates only to the design, examination and tests of the specified equipment and not to the manufacturing process and supply of this equipment.

(12) The marking of the equipment shall include the following:

Ex

II 3 G EEx nA II T4 and
II 3 D IP65 T85 °C

This certificate is issued on March 21, 2008 and, as far as applicable, shall be revised before the date of cessation of presumption of conformity of (one of) the standards mentioned above as communicated in the Official Journal of the European Union.

KEMA Quality B.V.

C.G. van Es
Certification Manager

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Experience you can trust.

Table 5-2: Pressure Matrix

Size	Flange	Applicable Gastket types	MAWP @ 21C [bar]	MAWP @ 70C [bar]	P.E.D. Module H Category
1½"	<Threaded>	N/A	80	75	2
	150#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	300#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	PN40	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
2"	<Threaded>	N/A	65	60	2
	150#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	300#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	PN40	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
3"	150#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	300#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	600#	Up to spiral wound	84	77	2
	PN40	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	PN64	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	PN100	Up to spiral wound	84	77	2
4"	150#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	300#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	600#	Up to spiral wound	78	71	2
	PN16	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	PN40	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	PN64	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
6"	150#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	2
	300#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	3
	600#	Up to spiral wound	60	55	3
	PN16	Up to elastomeric	Acc. Std flange ratings	Acc. Std flange ratings	2
	PN40	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	3
	PN64	Up to spiral wound	60	55	3
8"	150#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	3
	300#	Up to spiral wound	Acc. Std flange ratings	Acc. Std flange ratings	3
	PN10	Up to elastomeric	Acc. Std flange ratings	Acc. Std flange ratings	2
	PN16	Up to elastomeric	Acc. Std flange ratings	Acc. Std flange ratings	2
	PN25	Up to elastomeric	Acc. Std flange ratings	Acc. Std flange ratings	3
	PN64	Up to spiral wound	48	45	3

Section 6: Modellisting

					ENHANCEMENTS
	A				STANDARD RESPONSE:< 1 SEC (MF50/51) < 3 SEC (MF53) [1].
	B				FAST RESPONSE (SPECIFY VALUES .... SEC.) [1]
	C				LINEAR RAMP (SPECIFY VALUES ....%/SEC.) [1]
	D				FLOW OUTPUT DAMPING (SPECIFY VALUES .... SEC.) [1]
					ENHANCEMENTS
		0			UNCALIBRATED **DEDUCT**
		1			STANDARD CALIBRATION INCLUDED (SEE OPTION C)
		2			STORAGE OF MULTIPLE CAL. CURVES; ADD PER AVAILABLE CALIBRATION GAS
		9			SPECIFY
					POWER SUPPLY INPUT
			B		+ 24 Vdc = (Standard selection)
			Z		SPECIFY
					AREA CLASSIFICATION
				1	SAFE AREA [2D]
				2	CERTIFIED FOR USE IN ZONE 2 [2D]
				3	UL LISTED (NPT ENTRY) (ONLY MF64)
				4	UL RECOGNIZED (PG11 ENTRY) (ONLY MF64)
				5	WELDED SENSOR, NO CERT, (NPT ENTRY) (ONLY MF64) [2D]
				6	WELDED SENSOR, NO CERT, (PG11 ENTRY) (ONLY MF64) [2D]
				9	SPECIFY
MF50S / A C 1 H C 1 B A 0 K C 1 B 2 =					**TYPICAL MODEL NUMBER**

NOTES:	
1.	**ENHANCEMENTS**
PLEASE FILL IN THE REQUESTED SPECIFICATIONS WHEN YOU HAVE DESCRIBED THE ENHANCEMENTS. Standard response time of the flow output signal: Model MF50/51 and MF60/60, standard 1 sec. or on request better than 0.2 sec. Model MF53/63, standard 3 sec. or on request better than 1 sec. Model MF64, 3 sec. Standard settling time for controllers: Model MF50/51, standard 1 sec. or on request better than 0.2 sec. Model MF53, standard 3 sec. or on request better than 1 sec. (to within 2%full scale of final value)	
2	**OPTIONS**
A) FOR GASES WHICH CLOG AND CONTAMINATE THE MFC EASILY, AN ANTI-CLOG LAMINAR FLOW ELEMENT MUST BE ORDERED. FOR FLOW RANGES UP TO 3460 mln/min. N2, ADD:	
B) DIN/ANSI (PN40/150 LBS PRESSURE RATING) FLANGED CONNECTION FOR THE 1,5" AND 2" MF64S	
C) ENHANCED ACCURACY SPECIFICATIONS: 0.5% OF RATE PLUS 0.1% F.S. (Flow range 50 mln/min to 100 ln/min)	
D) NOT FOR UL LISTED OR RECOGNIZED MODELS.	

MF53S/A1		MASS FLOW CONTROLLER; F.S. FLOWRANGES: 1001 - 1100 ln/min.		
MF53S/A2		MASS FLOW CONTROLLER; F.S. FLOWRANGES: 1101 - 1300 ln/min.		
MF53S/A3		MASS FLOW CONTROLLER; F.S. FLOWRANGES: 1301 - 1600 ln/min.		
MF53S/A4		MASS FLOW CONTROLLER; F.S. FLOWRANGES: 1601 - 1900 ln/min.		
MF53S/A5		MASS FLOW CONTROLLER; F.S. FLOWRANGES: 1 901 - 2200 ln/min.		
MF53S/A6		MASS FLOW CONTROLLER; F.S. FLOWRANGES: 2201 - 2500 ln/min.		
		MECHANICAL CONNECTIONS		
1A		WITHOUT ADAPTORS (9/16"-18" UNF)		(ONLY FOR MF50/60/51/61/53/63)
1B		1/4"	TUBE COMPRESSION FITTINGS	(ONLY FOR MF50/60/51/61)
1C		1/8"	TUBE COMPRESSION FITTINGS	(ONLY FOR MF50/60/51/61)
1D		3/8"	TUBE COMPRESSION FITTINGS	(ONLY FOR MF50/60/51/61)
1E		1/4"	VCR	(ONLY FOR MF50/60/51/61)
1F		1/4"	VCO	(ONLY FOR MF50/60/51/61)
1G		1/4"	NPT	(ONLY FOR MF50/60/51/61)
1H		6mm	TUBE COMPRESSION FITTINGS	(ONLY FOR MF50/60/51/61)
1J		10mm	TUBE COMPRESSION FITTINGS	(ONLY FOR MF50/60/51/61)
1K		1/4"	BSP (F)	(ONLY FOR MF50/60/51/61)
1Y		½"	BSP (F)	(ONLY FOR MF53/63)
1Z		1"	BSP (F)	(ONLY FOR MF53/63)

2A		1 1/16" - 12SAE/MS		(ONLY FOR MF53/63)
2B		½"	TUBE COMPRESSION FITTINGS	(ONLY FOR MF50/60/51/61/53/63)
2C		3/4"	TUBE COMPRESSION FITTINGS	(ONLY FOR MF53/63)
2D		1"	TUBE COMPRESSION FITTINGS	(ONLY FOR MF53/63)
2E		½"	NPT(F)	(ONLY FOR MF53/63)
2F		1"	NPT(F)	(ONLY FOR MF53/63)
2G		1½"	NPT(F) (SEE OPTION "B")	(ONLY FOR MF53/63/64)
2H		½"	VCO (200 ln/min. max.)	(ONLY FOR MF50/60/51/61/53/63)
2J		3/4"	VCO	(ONLY FOR MF53/63)
2K		½"	VCR (200 ln/min. max.)	(ONLY FOR MF50/60/51/61/53/63)
2L		DIN DN15PN40		(ONLY FOR MF53/63)
2M		DIN DN25PN40		(ONLY FOR MF53/63)
2N		DIN DN40PN40	(see option "B" for MF64)	(ONLY FOR MF53/63/64)
2O		DIN DN50PN40	(see option "B" for MF64)	(ONLY FOR MF53/63/64)
2P		ANSI ½" 150 LBS		(ONLY FOR MF53/63)
2R		ANSI ½" 300 LBS		(ONLY FOR MF53/63)
2S		ANSI 1" 150 LBS		(ONLY FOR MF53/63)
2T		ANSI 1" 300 LBS		(ONLY FOR MF53/63)
2U		ANSI 1½" 150 LBS	(see option "B" for MF64)	(ONLY FOR MF53/63/64)
2V		ANSI 1½" 300 LBS		(ONLY FOR MF53/63)

2W		ANSI 2" 150 LBS (see option "B" for MF64)	(ONLY FOR MF53/63/64)
2X		ANSI 2" 300 LBS	(ONLY FOR MF53/63)
2Y		1" VCO	(ONLY FOR MF53/63)
2Z		3/4" VCR	(ONLY FOR MF53/63)
3A		2"NPT (SEE OPTIONS B)	(MF64 ONLY)
3B		ANSI 3" - 150 LBS	(MF64 ONLY)
3C		ANSI 3" - 300 LBS	(MF64 ONLY)
3D		ANSI 3" - 600 LBS [2D]	(MF64 ONLY)
3E		DIN DN80 - PN40 [2D]	(MF64 ONLY)
3F		DIN DN80 - PN64 [2D]	(MF64 ONLY)
3G		DIN DN80 - PN100 [2D]	(MF64 ONLY)
4A		ANSI 4" - 150 LBS	(MF64 ONLY)
4B		ANSI 4" - 300 LBS	(MF64 ONLY)
4C		ANSI 4" - 600 LBS [2D]	(MF64 ONLY)
4D		DIN DN100 - PN16 [2D]	(MF64 ONLY)
4E		DIN DN100 - PN40 [2D]	(MF64 ONLY)
4F		DIN DN100 - PN64 [2D]	(MF64 ONLY)
5A		6" ANSI - 150 LBS [2D]	(MF64 ONLY)
5B		6" ANSI - 300 LBS [2D]	(MF64 ONLY)
5C		6" ANSI - 600 LBS [2D]	(MF64 ONLY)
5D		DIN DN 150 - PN 16 [2D]	(MF64 ONLY)
5E		DIN DN 150 - PN 40 [2D]	(MF64 ONLY)
5F		DIN DN 150 - PN 64 [2D]	(MF64 ONLY)
6A		ANSI 8" - 150 LBS [2D]	(MF64 ONLY)
6B		ANSI 8" - 300 LBS [2D]	(MF64 ONLY)
6C		DIN DN200 - PN10 [2D]	(MF64 ONLY)
6D		DIN DN200 - PN16 [2D]	(MF64 ONLY)
6E		DIN DN200 - PN25 [2D]	(MF64 ONLY)
6F		DIN DN200 - PN64 [2D]	(MF64 ONLY)
9Z		SPECIFY	

								O-RING/VALVE SEAT MATERIAL	
	A							VITON	
	B							BUNA (NOT FOR MF53)	
	C							PTFE/KALREZ (KALREZ FOR SENSOR 0-RINGS AND VALVE SEAT) [2D]	
	D							KALREZ (NOT FOR MF53) [2D]	
	E							PTFE/EPDM (EPDM ONLY FOR VALVE SEAT) [2D]	
	F							PTFE [2D]	
	Z							SPECIFY	
								VALVE TYPE	
		0						METER ONLY (NO VALVE)	
		1						NORMALLY CLOSED (MF50/51 SERIES)	
		2						NORMALLY CLOSED (PRESS.DIFF. >2BAR. MF53 SERIES)	
		3						NORMALLY CLOSED (PRESS.DIFF. <2BAR. MF53 SERIES)	
		4						NORMALLY OPENED (MF50 ONLY)	
		9						SPECIFY	
								ELECTRICAL INPUT/OUTPUT	
								INPUT	**OUTPUT**
			A					0-5Vdc	0-5 Vdc & 0-20mA (INCL. RS 232, 9600 BDS)
			B					4-20mA	4-20 mA & 1-5Vdc (INCL. RS 232, 9600 BDS)
			C					0-20 mA	0-20mA & 0-5Vdc (INCL. RS 232, 9600 BDS)
			D					1-5Vdc	1-5 Vdc & 4-20mA (INCL. RS 232, 9600 BDS)
			E					DIG. COMM.	DIG. COMM. + 0 - 5 Vdc
			F					DIG. COMM.	DIG. COMM. + 4 - 20 mA
			G					DIG. COMM.	DIG. COMM. + 0 - 20 mA
			H					DIG. COMM.	DIG. COMM. + 1 - 5 Vdc
			I					DIG. COMM.	DIGITAL COMMUNICATION (ONLY)
			Z					SPECIFY	
								COMMUNICATION / BAUDRATE	
				A0				NONE (Communication w ill be possible via RS/232 and 9600 baud)	
				B*				RS232	
				C*				RS485	
				D0				PROFIBUS-DP (**PNO CERTIFIED**, 831-A-023 and 541-C-068-AAG)	
				*1				38400 Baud	
				*2				19200	
				*3				9600	
				*4				7200	
				*5				4800	
				*6				3600	
				*7				2400 * BOTH HAVE TO BE SPECIFIED	
				*8				1200	
								ELECTRICAL CONNECTION	
					K			PG11 CABLE GLAND	
					L			1/2" NPT ADAPTER CONDUIT ENTRY	
					Z			SPECIFY	

					ENHANCEMENTS
	A				STANDARD RESPONSE:< 1 SEC (MF50/51) < 3 SEC (MF53) [1].
	B				FAST RESPONSE (SPECIFY VALUES .... SEC.) [1]
	C				LINEAR RAMP (SPECIFY VALUES ....%/SEC.) [1]
	D				FLOW OUTPUT DAMPING (SPECIFY VALUES .... SEC.) [1]
					ENHANCEMENTS
		0			UNCALIBRATED **DEDUCT**
		1			STANDARD CALIBRATION INCLUDED (SEE OPTION C)
		2			STORAGE OF MULTIPLE CAL. CURVES; ADD PER AVAILABLE CALIBRATION GAS
		9			SPECIFY
					POWER SUPPLY INPUT
			B		+ 24 Vdc = (Standard selection)
			Z		SPECIFY
					AREA CLASSIFICATION
				1	SAFE AREA [2D]
				2	CERTIFIED FOR USE IN ZONE 2 [2D]
				3	UL LISTED (NPT ENTRY) (ONLY MF64)
				4	UL RECOGNIZED (PG11 ENTRY) (ONLY MF64)
				5	WELDED SENSOR, NO CERT, (NPT ENTRY) (ONLY MF64) [2D]
				6	WELDED SENSOR, NO CERT, (PG11 ENTRY) (ONLY MF64) [2D]
				9	SPECIFY
MF50S / A C 1 H C 1 B A 0 K C 1 B 2 =					**TYPICAL MODEL NUMBER**

NOTES:

1. ENHANCEMENTS

PLEASE FILL IN THE REQUESTED SPECIFICATIONS WHEN YOU HAVE DESCRIBED THE ENHANCEMENTS.
Standard response time of the flow output signal: Model MF50/51 and MF60/60, standard 1 sec. or on request better than 0.2 sec. Model MF53/63, standard 3 sec. or on request better than 1 sec. Model MF64, 3 sec.
Standard settling time for controllers: Model MF50/51, standard 1 sec. or on request better than 0.2 sec. Model MF53, standard 3 sec. or on request better than 1 sec. (to w ithin 2%full scale of final value)

2 OPTIONS

A) FOR GASES WHICH CLOG AND CONTAMINATE THE MFC EASILY, AN ANTI-CLOG LAMINAR FLOW ELEMENT MUST BE ORDERED. FOR FLOW RANGES UP TO 3460 mln/min. N2, ADD:

B) DIN/ANSI (PN40/150 LBS PRESSURE RATING) FLANGED CONNECTION FOR THE 1,5" AND 2" MF64S

C) ENHANCED ACCURACY SPECIFICATIONS: 0.5% OF RATE PLUS 0.1% F.S. (Flow range 50 mln/min to 100 ln/min)

D) NOT FOR UL LISTED OR RECOGNIZED MODELS.

Appendix A: Gas Conversion Tables

USE OF THE CONVERSION TABLES

If a Mass Flow Meter or Controller is operated on a gas other than the gas it was calibrated with, a scale shift will occur in the relationship between the output signal and the mass flow rate as a result of the difference in heat capacities between the two gases. This scale shift can be calculated by using the ratio of the molar specific heat of the two gases, or the sensor conversion factor.

The gasconversion table is available at Brooks Instrument under document no.: J-836-D-508.

USE OF A MFC/M FOR A DIFFERENT GAS THAN IT IS CALIBRATED FOR:

For use with a different gas type, multiply the output reading by the ratio of the gas factor of the desired gas and the gas factor of the calibrated gas.

$$\text{Actual gas Flow rate} = \text{Output Reading} \times \frac{\text{Factor of the new gas}}{\text{Factor of the calibrated gas}}$$

Example:
The controller is calibrated for nitrogen: 1000mln/min full scale.
The desired gas is carbon dioxide. Multiply the output reading by 0.740 to calculate the flow of carbon dioxide. When the output reading is 750 mln/min, the flow rate for carbon dioxide is 750 x 0.740 = 555 ml_n/min.

CALCULATE GAS FACTOR FOR MIX GASSES:
In order to calculate the conversion factor for a gas mixture the following formula should be used:

$$\text{Sensor conversion factor for Mixture} = \frac{100}{\left(\frac{P1}{\text{sensor conversion factor 1}}\right) + \left(\frac{P2}{\text{sensor conversion factor 2}}\right) + \left(\frac{Pn}{\text{sensor conversion factor n}}\right)}$$

Where P1= percentage (%) of gas 1 (by volume)
P2= percentage (%) of gas 2 (by volume)
Pn= percentage (%) of gas n (by volume)

Example:
The desired gas is 20% Helium (He) and 80% Chlorine (Cl_2) by volume. The desired full-scale flow rate of the mixture is 20 ln/min.
Sensor conversion factor for the mixture is:

$$\text{Mixture Factor} = \frac{100}{\left(\frac{20}{1.386}\right) + \left(\frac{80}{0.876}\right)} = 0.946$$

N2equivalent flow = 20/0.946 = 21.14 ln/min .

NOTE:

It is generally accepted that the mass flow rate derived from this equation is only accurate to ± 5%. The table below lists the conversion factors for various gases with respect to nitrogen. The conversion table is used to determine the flow rate for gases other than the pre-selected gas. The flow meter is factory set to a pre-selected gas, pressure and flow range.

Gas Conversion Table: (Source J-836-D-508 Rev. 14)

Gasname	Formula	Gasfactor	Orifice factor	Density (kg/m3)
Acetylene (Ethyne)	C2H2	0,615	0,97	1,173
Air	Mixture	0,998	1,018	1,293
Allene	C3H4	0,478	1,199	1,787
Ammonia	NH3	0,786	0,781	0,771
Argon	Ar	1,395	1,195	1,784
Arsine	AsH3	0,754	1,661	3,478
Boron Trichloride	BCL3	0,443	2,044	5,227
Boron Trifluoride	BF3	0,579	1,569	3,025
Bromine Pentafluoride	BrF5	0,287	2,502	7,806
Bromine Trifluoride	BrF3	0,439	2,214	6,108
Bromotrifluoroethylene	C2BrF3	0,326	2,397	7,165
Bromotrifluoromethane (f-13B1)	CBrF3	0,412	2,303	6,615
1,3-Butadiene	C4H6	0,354	1,413	2,491
Butane	C4H10	0,257	1,467	2,593
1-Butene	C4H8	0,294	1,435	2,503
CIS-2-Butene	C4H8	0,32	1,435	2,503
Trans-2-Butene	C4H8	0,291	1,435	2,503
Carbon Dioxide	CO2	0,74	1,255	1,977
Carbon Disulfide	CS2	0,638	1,65	3,393
Carbon Monoxide	CO	0,995	1	1,25
Carbon Tetrachloride	CCL4	0,344	2,345	6,86
Carbon Tetrafluoride (f-14)	CF4	0,44	1,77	3,926
Carbonyl Fluoride	COF2	0,567	1,555	2,045
Carbonyl Sulfide	COS	0,68	1,463	2,68
Chlorine	CL2	0,876	1,598	3,214
Chlorine Dioxide	CLO2	0,693	1,554	3,011
Chlorine Trifluoride	CLF3	0,433	1,812	4,125
Chlorodifluoromethane (f-22)	CHCLF2	0,505	1,77	3,906
Chloroform (Trichloromethane)	CHCL3	0,442	2,066	5,34
Chloropentafluoroethane (f-115)	C2CLF5	0,243	2,397	7,165
Chlorotrifluoroethylene	C2CLF3	0,337	2,044	5,208
Chlorotrifluoromethane (f-13)	CCLF3	0,43	1,985	4,912
2-Chlorobutane	C4H9CL	0,234	1,818	4,134
Cyanogen	(CN)2	0,498	1,366	2,322
Cyanogen Chloride	CLCN	0,618	1,48	2,73
Cyclobutane	C4H8	0,387	1,413	2,491
Cyclopropane	C3H6	0,505	1,224	1,877
Deuterium	D2	0,995	0,379	0,177
Diborane	B2H6	0,448	1	1,235
Diboromodifluoromethane (f-12B2)	CBr2F2	0,363	2,652	8,768
1,2-Dibromotetrafluoroethane (f-114B2)	C2Br2F4	0,215	2,905	10,53
Dichlorodifluoromethane (f-12)	CCL2F2	0,39	2,099	5,492
Dichlorofluoromethane (f-21)	CHCL2F	0,456	1,985	4,912
Dichlorosilane	SiH2CL2	0,442	1,897	4,506
Diedthylsilane	C4H12Si	0,183	1,775	3,94
2,2 Dichloro- 1,1,1- Trifloroethane	C2HCL2F3	0,259	2,336	6,829
1,2-Dichloroethane (Ethylene dichloride)	C2H4CL2	0,382	1,879	4,419
1,2-Dichlorotetrafluoroethane (f-114)	C2CL2F4	0,231	2,449	7,479
1,1-Difluoro-1-Chloroethane	C2H3CLF2	0,341	1,957	4,776
1,1-Difluoroethane	CH3CHF2	0,415	1,536	2,94
1,1-Difluoroethylene	CH2:CF2	0,458	1,512	2,86
Difluoromethane (f-32)	CF2H2	0,627	1,36	2,411

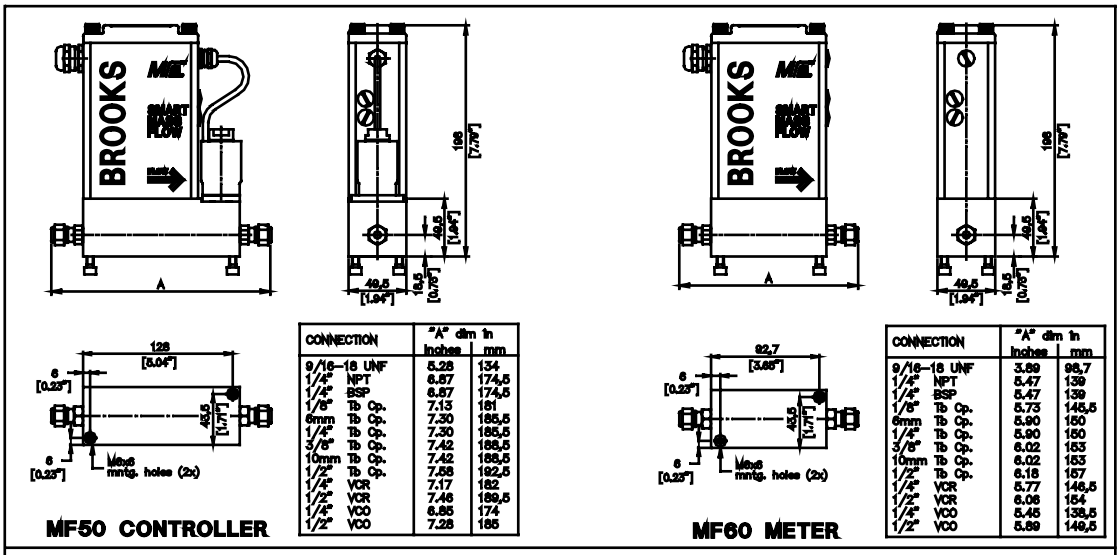
Gas Conversion Table (continued)

Gasname	Formula	Gasfactor	Orifice factor	Density (kg/m3)
Dimethylamine	(CH3)2NH	0,37	1,269	2,013
Dimethylether	(CH3)2O	0,392	1,281	2,055
2,2-Dimethylpropane	C(CH3)4	0,247	1,613	3,244
Disilane	Si2H6	0,332	1,493	2,779
Ethane	C2H6	0,49	1,038	1,357
Ethanol	C2H6O	0,394	1,282	2,057
Ethylacetylene	C4H6	0,365	1,384	2,388
Ethyl Chloride	C2H5CL	0,408	1,516	2,879
Ethylene	C2H4	0,619	1	1,261
Ethylene Oxide	C2H4O	0,589	1,254	1,965
Fluorine	F2	0,924	1,163	1,695
Fluoroform (f-23)	CHF3	0,529	1,584	3,127
Germane	GeH4	0,649	1,653	3,418
Germanium Tetrachloride	GeCL4	0,268	2,766	9,574
Halothane	C2HBrCLF	0,257	2,654	8,814
Helium	He	1,386	0,378	0,178
Hexafluoroacetone	C3F6O	0,219	2,434	7,414
Hexafluorobenzine	C6F6	0,632	2,577	8,309
Hexafluoroethane (f-116)	C2F6	0,255	2,219	6,139
Hexafluoropropylene (HFP)	C3F6	0,249	2,312	6,663
Hexamethyldisilane (HMDS)	(CH2)6Si2	0,139	2,404	7,208
Hexane	C6H14	0,204	1,757	3,847
Hydrogen	H2	1,008	0,269	0,09
Hydrogen Bromide	HBr	0,987	1,695	3,645
Hydrogen Chloride	HCL	0,983	1,141	1,639
Hydrogen Cyanide	HCN	0,744	0,973	1,179
Hydrogen Fluoride	HF	0,998	0,845	0,893
Hydrogen Iodide	HI	0,953	2,144	5,789
Hydrogen Selenide	H2Se	0,837	1,695	3,613
Hydrogen Sulfide	H2S	0,85	1,108	1,539
Iodine Pentafluoride	IF5	0,283	2,819	9,907
Isobutane	C4H10	0,26	1,44	2,596
Isobutene	C4H8	0,289	1,435	2,503
Isopentane	C5H12	0,211	1,605	3,222
Krypton	Kr	1,382	1,729	3,708
Methane	CH4	0,763	0,763	0,717
Methylacetylene	C3H4	0,473	1,196	1,782
Methyl Bromide	CH3Br	0,646	1,834	4,236
3-Methyl-1-butene	C5H10	0,252	1,584	3,127
Methyl Chloride	CH3CL	0,687	1,347	2,308
Methyl Fluoride	CH3F	0,761	1,102	1,518
Methyl Mercaptan	CH4S	0,588	1,313	2,146
Methyl Silane	CH6Si	0,393	1,283	2,061
Methyl Trichlorosilane	CH3CL3Si	0,267	2,31	6,675
Methyl Vinyl Ether	C3H6O	0,377	1,435	2,567
Monoethyanolamine	C2H7NO	0,305	1,477	2,728
Monoethylamine (CH3CH2NH2)	C2H7	0,359	1,269	2,013
Monomethylamine	CH3NH2	0,565	1,067	1,42
Neon	Ne	1,398	0,847	0,902
Nickel Carbonyl	Ni(CO)4	0,212	2,371	7,008
Nitric Oxide	NO	0,995	1,03	1,339
Nitrogen	N2	1	1	1,251
Nitrogen Dioxide	NO2	0,758	1,713	2,052
Nitrogen Trifluoride	NF3	0,501	1,598	3,168

Gas Conversion Table (continued)

Gasname	Formula	Gasfactor	Orifice factor	Density (kg/m3)
Nitrogen Trioxide	N2O3	0,443	1,649	3,389
Nitrosyl Chloride	NOCL	0,644	1,529	2,913
Nitrous Oxide	N2O	0,752	1,259	1,964
Octofluorocyclobutane	C4F8	0,169	2,672	8,933
Oxygen	O2	0,988	1,067	1,429
Oxygen Difluoride	OF2	0,672	1,388	2,402
Ozone	O3	0,738	1,31	2,138
Perchloryl Fluoride	CLO3F	0,448	1,905	4,571
Perfluorobutane	C4F10	0,738	2,918	10,61
Perfluoro-2-Butene	C4F8	0,268	2,672	8,933
Perfluoromethyl-vinylether (PMVE)	PMVE	0,296	2,029	5,131
Perfluoropropane	C3F8	0,179	2,591	8,396
Pentane (n-Pentane)	C5H12	0,212	1,605	3,222
Pentafluoroethane	C2HF5	0,287	2,07	5,36
Phosgene	COCL2	0,504	1,881	4,418
Phosphine	PH3	0,783	1,1	1,517
Phosphorous Pentafluoride	PF5	0,346	2,109	5,62
Phosphorous Trifluoridide	PF3	0,495	1,77	3,906
Propane (same as CH3CH2CH3)	C3H8	0,343	1,274	2,008
Propylene (Propene)*	C3H6	0,401	1,234	1,875
Rhenium Hexafluoride	ReF6	0,23	3,279	13,41
Silane	SiH4	0,625	1,07	1,44
Silicon Tetrachloride	SiCL4	0,31	2,462	7,579
Silicon Tetrafluoride	SiF4	0,395	1,931	4,648
Sulfur Dioxide	SO2	0,728	1,529	2,858
Sulfur Hexafluoride	SF6	0,27	2,348	6,516
Sulfur Tetrafluoride	SF4	0,353	1,957	4,776
Sulfur Trioxide	SO3	0,535	1,691	3,575
Sulfuryl Fluoride	SO2F2	0,423	1,931	4,648
Tetrachloromethane	CCL4	0,344	2,345	6,858
Tetrafluoroethylene (TFE)	C2F4	0,361	1,905	4,526
Tetrafluorohydrazine	N2F4	0,367	1,926	4,624
Trichlorofluoromethane (f-11)	CCL3F	0,374	2,244	6,281
Trichlorosilane	SiHCL3	0,329	2,201	6,038
Trimethyloxyborane (TMB)	B(OCH3)3	0,3	1,929	4,638
1,1,2-Trichloro-1,1,2-Triflouroet (f-113)	C2CL3F3	0,231	2,52	7,92
Trimethylamine	(CH3)3N	0,316	1,467	2,639
Tungsten Hexafluoride	WF6	0,227	3,264	13,28
Uranium Hexafluoride	UF6	0,22	3,548	15,7
Vinyl Bromide	C2H3Br	0,524	1,985	4,772
Vinyl Chloride	C2H3CL	0,542	1,492	2,788
Vinyl Fluoride	C2H3F	0,576	1,281	2,046
Water Vapor	H2O	0,861	0,802	0,804
Xenon	Xe	1,383	2,18	5,851

Appendix B: Dimensional Drawings

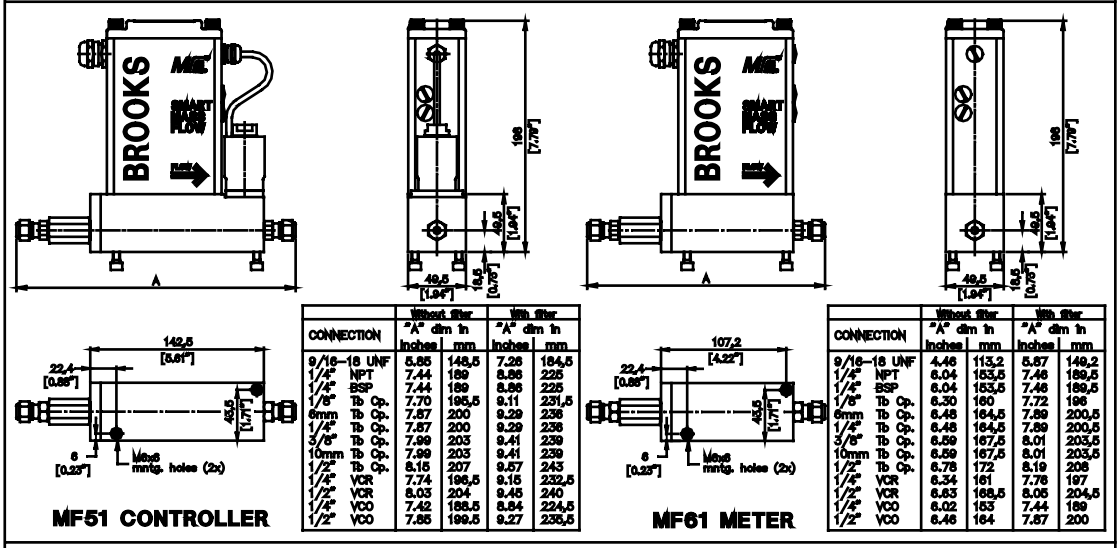


CONNECTION	"A" dim in	
	Inches	mm
9/16–18 UNF	5.28	134
1/4" NPT	6.87	174,5
1/4" BSP	6.87	174,5
1/8" Tb Cp.	7.13	181
6mm Tb Cp.	7.30	185,5
1/4" Tb Cp.	7.30	185,5
3/8" Tb Cp.	7.42	188,5
10mm Tb Cp.	7.42	188,5
1/2" Tb Cp.	7.58	192,5
1/4" VCR	7.17	182
1/2" VCR	7.46	189,5
1/4" VCO	6.85	174
1/2" VCO	7.28	185

MF50 CONTROLLER

CONNECTION	"A" dim in	
	Inches	mm
9/16–18 UNF	3.89	98,7
1/4" NPT	5.47	139
1/4" BSP	5.47	139
1/8" Tb Cp.	5.73	145,5
6mm Tb Cp.	5.90	150
1/4" Tb Cp.	5.90	150
3/8" Tb Cp.	6.02	153
10mm Tb Cp.	6.02	153
1/2" Tb Cp.	6.18	157
1/4" VCR	5.77	146,5
1/2" VCR	6.06	154
1/4" VCO	5.45	138,5
1/2" VCO	5.89	149,5

MF60 METER

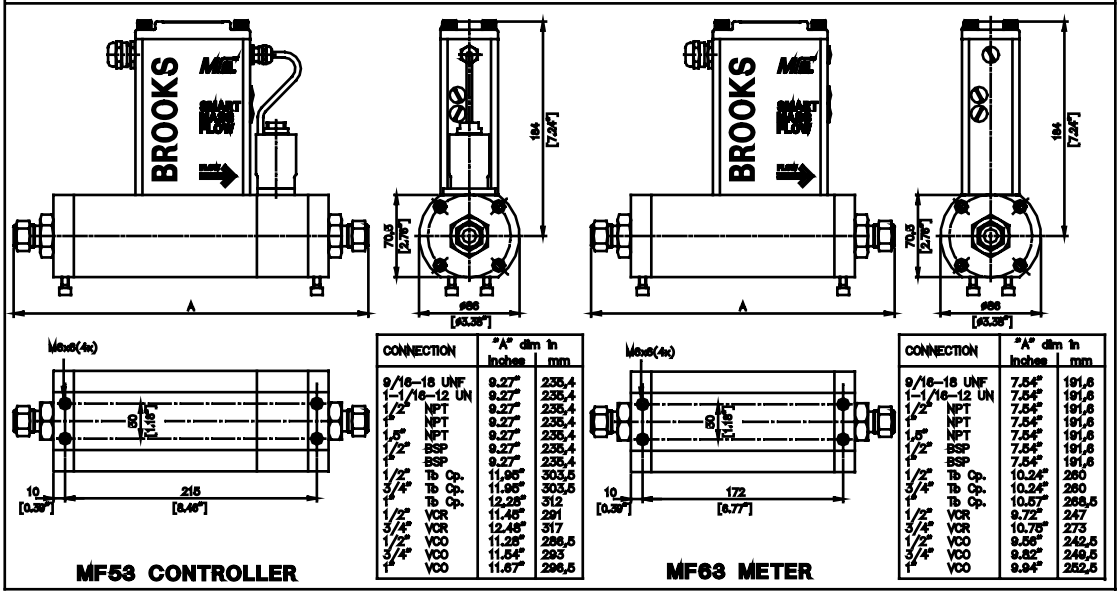


CONNECTION	Without filter		With filter	
	"A" dim in		"A" dim in	
	Inches	mm	Inches	mm
9/16–18 UNF	5.85	148,5	7.26	184,5
1/4" NPT	7.44	189	8.86	225
1/4" BSP	7.44	189	8.86	225
1/8" Tb Cp.	7.70	195,5	9.11	231,5
6mm Tb Cp.	7.87	200	9.29	236
1/4" Tb Cp.	7.87	200	9.29	236
3/8" Tb Cp.	7.99	203	9.41	239
10mm Tb Cp.	7.99	203	9.41	239
1/2" Tb Cp.	8.15	207	9.57	243
1/4" VCR	7.74	196,5	9.15	232,5
1/2" VCR	8.03	204	9.45	240
1/4" VCO	7.42	188,5	8.84	224,5
1/2" VCO	7.85	199,5	9.27	235,5

MF51 CONTROLLER

CONNECTION	Without filter		With filter	
	"A" dim in		"A" dim in	
	Inches	mm	Inches	mm
9/16–18 UNF	4.46	113,2	5.87	149,2
1/4" NPT	6.04	153,5	7.46	189,5
1/4" BSP	6.04	153,5	7.46	189,5
1/8" Tb Cp.	6.30	160	7.72	196
6mm Tb Cp.	6.48	164,5	7.89	200,5
1/4" Tb Cp.	6.48	164,5	7.89	200,5
3/8" Tb Cp.	6.59	167,5	8.01	203,5
10mm Tb Cp.	6.59	167,5	8.01	203,5
1/2" Tb Cp.	6.78	172	8.19	208
1/4" VCR	6.34	161	7.76	197
1/2" VCR	6.63	168,5	8.05	204,5
1/4" VCO	6.02	153	7.44	189
1/2" VCO	6.46	164	7.87	200

MF61 METER



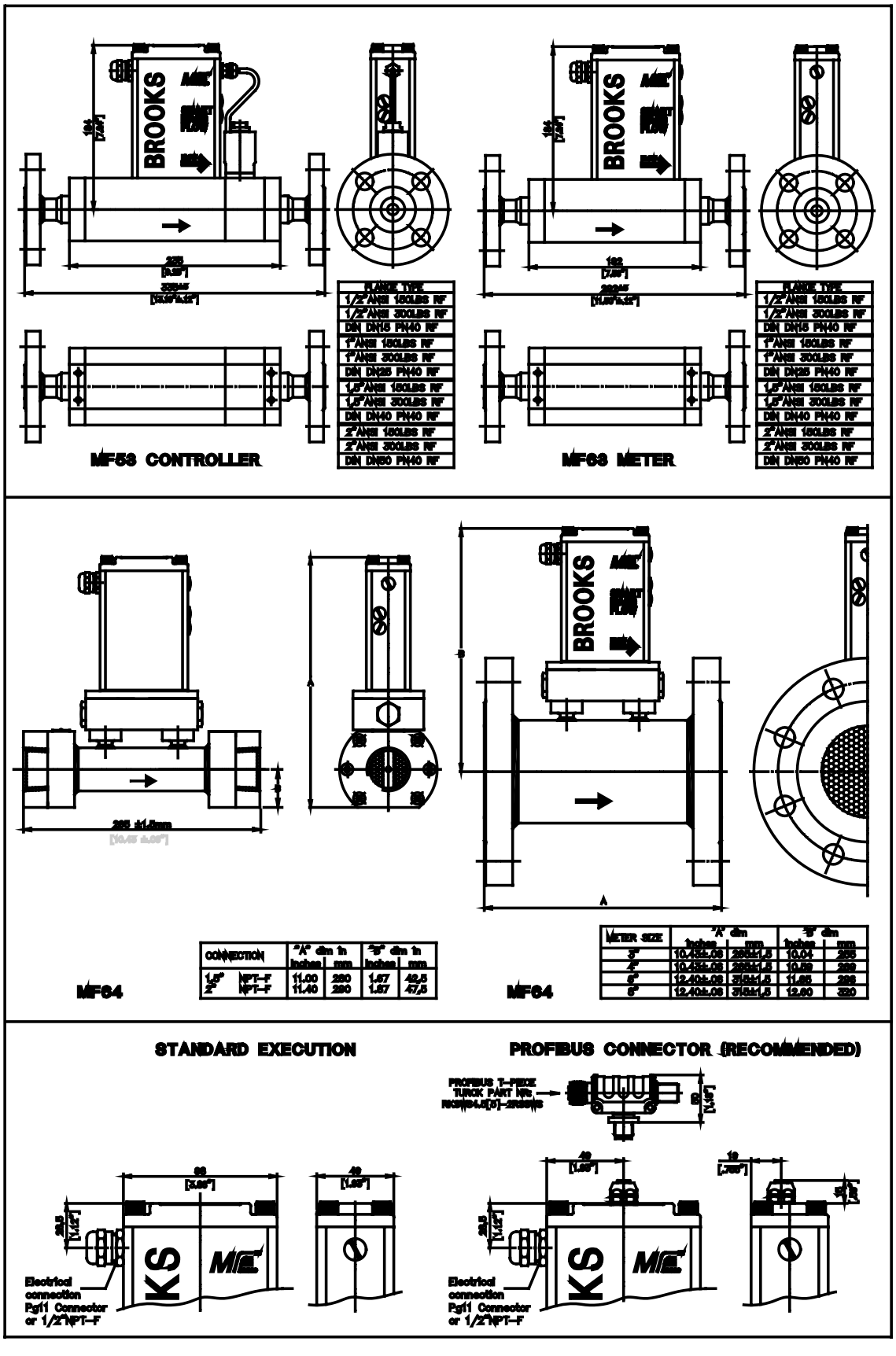
CONNECTION	"A" dim in	
	Inches	mm
9/16–18 UNF	9.27"	235,4
1–1/16–12 UN	9.27"	235,4
1/2" NPT	9.27"	235,4
1" NPT	9.27"	235,4
1,5" NPT	9.27"	235,4
1/2" BSP	9.27"	235,4
1" BSP	9.27"	235,4
1/2" Tb Cp.	11.95"	303,5
3/4" Tb Cp.	11.95"	303,5
1" Tb Cp.	12.28"	312
1/2" VCR	11.45"	291
3/4" VCR	12.45"	317
1/2" VCO	11.28"	286,5
3/4" VCO	11.54"	293
1" VCO	11.67"	296,5

MF53 CONTROLLER

CONNECTION	"A" dim in	
	Inches	mm
9/16–18 UNF	7.54"	191,6
1–1/16–12 UN	7.54"	191,6
1/2" NPT	7.54"	191,6
1" NPT	7.54"	191,6
1,5" NPT	7.54"	191,6
1/2" BSP	7.54"	191,6
1" BSP	7.54"	191,6
1/2" Tb Cp.	10.24"	260
3/4" Tb Cp.	10.24"	260
1" Tb Cp.	10.57"	268,5
1/2" VCR	9.72"	247
3/4" VCR	10.76"	273
1/2" VCO	9.56"	242,5
3/4" VCO	9.82"	249,5
1" VCO	9.94"	252,5

MF63 METER

-


BROOKS
MF53 CONTROLLER
MF63 METER
MF64
MF64
STANDARD EXECUTION
PROFIBUS CONNECTOR (RECOMMENDED)
Electrical connection Pg11 Connector or 1/2"NPT-F
Electrical connection Pg11 Connector or 1/2"NPT-F

Appendix C: Translation of CE Marking electrical installation instructions

Dansk

Brooks Instrument har gennemført CE mærkning af elektronisk udstyr med succes, i henhold til regulativet om elektrisk støj (EMC direktivet 89/336/EEC). Der skal dog gøres opmærksom på benyttelsen af signalkabler i forbindelse med CE mærkede udstyr.

Kvaliteten af signal kabler og stik:
Brooks lever kabler af høj kvalitet, der imødekommer specifikationerne til CE mærkning.

Hvis der anvendes andre kabel typer skal der benyttes et skærmet kabel med hel skærm med 80% dækning.
Forbindelses stikket type “D” eller “cirkulære”, skal være skærmet med metalhus og eventuelle PG-forskruninger skal enten være af metal eller metal skærmet. Skærmen skal forbindes, i begge ender, til stikkets metalhus eller PG-forskruningen og have forbindelse over 360 grader. Skærmen bør være forbundet til jord.

“Card Edge” stik er standard ikke af metal, der skal derfor ligeledes benyttes et skærmet kabel med hel skærm med 80% dækning. Skærmen bør være forbundet til jord.

Deutsch

Nach erfolgreichen Tests enstprechend den Vorschiften der Elektromagnetischen Verträglichkeit (EMC Richtlinie 89/336/EEC) erhalten die Brooks-Geräte (elektrische/elektronische Komponenten) das CE-Zeichen.
Bei der Auswahl der Verbindungskabel für CE-zertifizierte Geräte sind spezielle Anforderungen zu beachten.

Qualität der Verbindungskabel, Anschlußstecker und der Kabeldurchführungen

Die hochwertigen Qualitätskabel von Brooks entsprechen der Spezifikation der CE-Zertifizierung.
Bei Verwendung eigener Verbindungskabel sollten Sie darauf achten, daß eine 80 %igenSchirmababdeckung des Kabels gewährleistet ist.

„D“ oder „Rund“ -Verbindungsstecker sollten eine Abschirmung aus Metall besitzen.
Wenn möglich, sollten Kabeldurchführungen mit Anschlußmöglichkeiten für die Kabelabschirmung verwendet werden.
Die Abschirmung des Kabels ist auf beiden Seiten des Steckers oder der Kabeldurchführungen über den vollen Umfang von 360 ° anzuschließen. Die Abschirmung ist mit dem Erdpotential zu verbinden.

Platinen-Steckverbindunger sind standardmäßige keine metallgeschirmten Verbindungen. Um die Anforderungen der CE-Zertifizierung zu erfüllen, sind Kabel mit einer 80 %igen Schirmababdeckung zu verwenden.
Die Abschirmung ist mit dem Erdpotential zu verbinden.

English

All Brooks (electrical/electronic) equipment bearing the CE mark has been successfully tested in accordance with the Electromagnetic.
Compatibility regulations (EMC directive 89/336/EEC).
However, special care is required when selecting signal cables to be used with equipment bearing the CE mark.

Quality of signal cables, cable glands and connectors:

Brooks supplies high quality cabling that meets the specifications for CE certification.
However, if you wish to use your own signal cable, you should select one that is fully screened with at least 80% shielding.

Any ‘D’ or ‘Circular’ type connectors used should be screened with a metal shield. If applicable, metal cable glands must be used to clamp the cable shielding. The cable shielding should be connected to the metal shell or gland, and have 360° shielding at both ends.
The shielding should be connected to an earth terminal.

Card Edge Connectors are non-metallic, as standard. The cables used must be screened with 80% shielding to comply with CE certification.
The shielding should be connected to an earth terminal.

Español

Los equipos de Brooks (eléctricos/electrónicos) en relación con la marca CE han pasado satisfactoriamente las pruebas referentes a las regulaciones de Compatibilidad Electro magnetica (EMC directiva 89/336/EEC).
Sin embargo se requiere una atención especial en el momento de seleccionar el cable de señal cuando se va a utilizar un equipo con marca CE

Calidad del cable de señal, prensaestopas y conectores:

Brooks suministra cable(s) de alta calidad, que cumple las especificaciones de la certificación CE .
Si usted adquiere su propio cable de señal, debería usar un cable que esté completamente protegido en su conjunto con un apantallamiento del 80%.

Cuando utilice conectores del tipo «D» ó «Circular» deberían estar protegidos con una pantalla metálica. Cuando sea posible, se deberan utilizar prensaestopas metálicos provistos de abrazadera para la pantalla del cable.
La pantalla del cable deberá ser conectada al casquillo metálico ó prensa y protegida en ambos extremos completamente en los 360 Grados.
La pantalla deberá conectarse a tierra.

Los conectores estandar de tipo tarjeta (Card Edge) no son metálicos, los cables utilizados deberan ser protegidos con un apantallamiento del 80% para cumplir con la certificación CE.
La pantalla deberá conectarse a tierra.

Français

Les équipements Brooks (électriques/électroniques) portant le label CE ont été testés avec succès selon les règles de la Compatibilité Electromagnétique (directive CEM 89/336/EEC).
Cependant, la plus grande attention doit être apportée en ce qui concerne la sélection du câble utilisé pour véhiculer le signal d'un appareil portant le label CE.

Qualité du câble, des presse-étoupes et des connecteurs:

Brooks fournit des câbles de haute qualité répondant aux spécifications de la certification CE.
Si vous approvisionnez vous-même ce câble, vous devez utiliser un câble blindé à 80 %.

Les connecteurs « D » ou de type « circulaire » doivent être reliés à la terre.
Si des presse-étoupes sont nécessaires, ceux ci doivent être métalliques avec mise à la terre.
Le blindage doit être raccordé aux connecteurs métalliques ou aux presse-étoupes sur le pourtour complet du câble, et à chacune de ses extrémités.
Tous les blindages doivent être reliés à la terre.

Les connecteurs de type « card edge » sont non métalliques. Les câbles utilisés doivent être blindés à 80% pour satisfaire à la réglementation CE.
Tous les blindages doivent être reliés à la terre.

Greek

Τα όργανα (ηλεκτρικά/ηλεκτρονικά) της Brooks τα οποία φέρουν το σήμα CE έχουν επιτυχώς ελεγχθεί σύμφωνα με τους κανονισμούς της Ηλεκτρο-Μαγνητικής Συμβατότητας (EMC ντιρεκτίβα 89/336/EEC).
Οπωσδήποτε χρειάζεται ειδική προσοχή κατά τήν επιλογή του καλωδίου μεταφοράς του σήματος το οποίο (καλώδιο) πρόκειται να χρησιμοποιηθεί με όργανα που φέρουν το σήμα CE.

Ποιότητα του καλωδίου σήματος των στυπιοθλιπτών και των συνδέσμων .

Η Brooks κατά κανόνα προμηθεύει υψηλής ποιότητας καλώδια τα οποία πληρούν τις προδιαγραφές για πιστοποίηση CE.
Εάν η επιλογή του καλωδίου σήματος γίνει από σας πρέπει να χρησιμοποιήσετε καλώδιο το οποίο να φέρει εξωτερικά πλήρες πλέγμα και να παρέχει θωράκιση 80%

Οι σύνδεσμοι τύπου "D" ή "Κυκλικοί" των καλωδίων, πρέπει να θωρακίζονται με μεταλλική θωράκιση. Εάν είναι εφαρμόσιμο, πρέπει να χρησιμοποιούνται μεταλλικοί στυπιοθλίπτες καλωδίων που να διαθέτουν ακροδέκτη σύνδεσης του πλέγματος του καλωδίου.
Το πλέγμα του καλωδίου πρέπει να συνδέεται στο μεταλλικό περίβλημα ή στον στυπιοθλίπτη και να θωρακίζεται και στα δύο άκρα κατά 360 μοίρες.
Η θωράκιση πρέπει να καταλήγει σε κάποιο ακροδέκτη γείωσης.

Οι σύνδεσμοι καρτών είναι μη-μεταλλικοί, τα καλώδια που χρησιμοποιούνται πρέπει να φέρουν πλέγμα θωράκισης 80% για να υπακούουν στην πιστοποίηση CE.
Η θωράκιση πρέπει να καταλήγει σε κάποιο ακροδέκτη γείωσης.

Italiano

Questa strumentazione (elettrica ed elettronica) prodotta da Brooks Instrument, soggetta a marcatura CE, ha superato con successo le prove richieste dalla direttiva per la Compatibilità Elettomagnetica (Direttiva EMC 89/336/EEC).
E' richiesta comunque una speciale attenzione nella scelta dei cavi di segnale da usarsi con la strumentazione soggetta a marchio CE.

Qualità dei cavi di segnale e dei relativi connettori:

Brooks fornisce cavi di elevata qualità che soddisfano le specifiche richieste dalla certificazione CE. Se l'utente intende usare propri cavi, questi devono possedere una schermatura del 80%.

I connettori sia di tipo "D" che circolari devono possedere un guscio metallico. Se esiste un passacavo esso deve essere metallico e fornito di fissaggio per lo schermo del cavo.

Lo schermo del cavo deve essere collegato al guscio metallico in modo da schermarlo a 360° e questo vale per entrambe le estemità.
Lo schermo deve essere collegato ad un terminale di terra.

I connettori "Card Edge" sono normalmente non metallici. Il cavo impiegato deve comunque avere una schermatura del 80% per soddisfare la certificazione CE.
Lo schermo deve essere collegato ad un terminale di terra.

Nederlands

Alle CE gemarkeerde elektrische en elektronische produkten van Brooks Instrument zijn met succes getest en voldoen aan de wetgeving voor Electro Magnetische Compatibiliteit (EMC wetgeving volgens 89/336/EEC).
Speciale aandacht is echter vereist wanneer de signaalkabel gekozen wordt voor gebruik met CE gemarkeerde produkten.

Kwaliteit van de signaalkabel en kabelaansluitingen:
Brooks levert standaard kabels met een hoge kwaliteit, welke voldoen aan de specificaties voor CE certificering.
Indien men voorziet in een eigen signaalkabel, moet er gebruik gemaakt worden van een kabel die volledig is afgeschermd met een bedekkingsgraad van 80%.

“D” of “ronde” kabelconnectoren moeten afgeschermd zijn met een metalen connector kap. Indien kabelwartels worden toegepast, moeten metalen kabelwartels worden gebruikt die het mogelijk maken het kabelscherm in te klemmen
Het kabelscherm moet aan beide zijden over 360° met de metalen connectorkap, of wartel verbonden worden.
Het scherm moet worden verbonden met aarde.

“Card-edge” connectors zijn standaard niet-metallisch. De gebruikte kabels moeten volledig afgeschermd zijn met een bedekkingsgraad van 80% om te voldoen aan de CE certificering.
Het scherm moet worden verbonden met aarde.

Norsk

Til den det angår
Brooks Instrument elektrisk og elektronisk utstyr påført CE-merket har gjennomgått og bestått prøver som beskrevet i EMC forskrift om elektromagnetisk immunitet, direktiv 89/336/EEC.
For å opprettholde denne klassifisering er det av stor viktighet at riktig kabel velges for tilkobling av det måletekniske utstyret.
Utførelse av signalkabel og tilhørende plugger:
Brooks Instrument tilbyr levert med utstyret egnet kabel som møter de krav som stilles til CE-sertifisering.

Dersom kunden selv velger kabel, må kabel med fullstendig, 80% skjerming av lederene benyttes.
“D” type og runde plugger og forbindelser må være utført med kappe i metall og kabelnipler må være utført i metall for jordet innfesting av skjermen. Skjermen i kabelen må tilknyttes metallet i pluggen eller nippelen i begge ender over 360°, tilkoblet elektrisk jord.
Kort-kantkontakter er normalt utført i kunststoff. De tilhørende flatkabler må være utført med fullstendig, 80% skjerming som kobles til elektrisk jord på riktig pinne i pluggen, for å møte CE sertifiseringskrav.

Português

O equipamento (eléctrico/electrónico) Brooks com a marca CE foi testado com êxito nos termos do regulamento da Compatibilidade Electromagnética (directiva CEM 89/336/EEC).
Todavia, ao seleccionar-se o cabo de sinal a utilizar com equipamento contendo a marca CE, será necessário ter uma atenção especial.

Qualidade do cabo de sinal, buchas de cabo e conectores:

A Brooks fornece cabo(s) de qualidade superior que cumprem os requesitos da certificação CE.
Se fornecerem o vosso próprio cabo de sinal, devem utilizar um cabo que, na sua totalidade, seja isolado com uma blindagem de 80%.

Os conectores tipo “D” ou “Circulares” devem ser blindados com uma blindagem metálica. Se tal for necessário, deve utilizar-se buchas metálicas de cabo para o isolamento do aperto do cabo.
O isolamento do cabo deve ser ligado à blindagem ou bucha metálica em ambas as extremidades em 360º.
A blindagem deve terminar com a ligação à massa.

Os conectores “Card Edge” não são, em geral, metálicos e os cabos utilizados devem ter um isolamento com blindagem a 80% nos termos da Certificação CE..
A blindagem deve terminar com ligação à massa.

Suomi

Brooksin CE merkillä varustetut sähköiset laitteet ovat läpäissyt EMC testit (direktiivi 89/336/EEC).
Erityistä huomiota on kuitenkin kiinnitettävä signaalikaapelin valintaan.

Signaalikaapelin, kaapelin läpiviennin ja liittimen laatu

Brooks toimittaa korkealaatuisia kaapeleita, jotka täyttävät CE sertifikaatin vaatimukset. Hankkiessaan signaalikaapelin itse, olisi hankittava 80%:sti suojattu kaapeli.

“D” tai “Circular” tyyppisen liitimen tulisi olla varustettu metallisuojalla. Mikälì mahdollista, tulisi käyttää metallisia kaapeliliittimiä kiinnitettäessä suojaa.
Kaapelin suoja tulisi olla liitetty metallisuojaan tai liittimeen molemmissa päissä 360°:n matkalta.
Suojan tulisi olla maadoitettu.

“Card Edge Connector”it ovat standarditoimituksina ei-metallisia. Kaapeleiden täytyy olla 80%: sesti suojattuja jotta ne olisivat CE sertifikaatin mukaisia.
Suoja on oltava maadoitettu.

Svensk

Brooks (elektriska / elektronik) utrustning, som är CE-märkt, har testats och godkänts enligt gällande regler för elektromagnetisk kompabilitet (EMC direktiv 89/336/EEC).
Speciell hänsyn måste emellertid tas vid val av signalkabel som ska användas tillsammans med CE-märkt utrustning.

Kvalitet på signalkabel och anslutningskontakter:

Brooks levererar som standard, kablar av hög kvalitet som motsvarar de krav som ställs för CE-godkännande.
Om man använder en annan signalkabel ska kabeln i sin helhet vara skärmad till 80%.

“D” eller “runda” typer av anslutningskontakter ska vara skärmade. Kabelgenomföringar ska vara av metall alternativt med metalliserad skärmning.
Kabelns skärm ska, i bada ändar, vara ansluten till kontakternas metallkåpor eller genomföringar med 360 graders skärmning.
Skärmen ska avslutas med en jordförbindelse.

Kortkontakter är som standard ej metalliserade, kablar som används måste vara 80% skarmade för att överensstämma med CE-certifieringen.
Skärmen ska avslutas med en jordförbindelse.

Appendix D: Important Safety Instructions

ENGLISH

IMPORTANT SAFETY INSTRUCTIONS

This appendix contains important safety and operating instructions for use with the Thermal Mass Flow Meter / Controller Series. The instrument complies to the (PED) PRESSURE EQUIPMENT CE DIRECTIVE 97/23/EC. Consult local authorities as to national and/or local safety codes and any additional installation requirements.

SAFETY INSTRUCTIONS

1. Please read all instructions and cautionary markings on (1) the flowmeter and (2) all appropriate sections of the Instruction and Operating Manual before using this product.
2. WARNING: Do not operate this instrument in excess of the specifications, listed in the Instruction and Operating Manual. Failure to heed this warning can result in serious personal injury and/or damage to the equipment.
3. Please make sure that the instrument is properly connected to electrical and pressure sources.
4. OPERATION: (a) Slowly initiate flow into the system. Open process valves slowly to avoid flow surges. (b) Check for leaks around the meter inlet and outlet connections. If no leaks are present, bring the system up to operating pressure.
5. WARNING: If this equipment is not properly serviced, serious personal injury and/or damage to the equipment can result from potentially high operating pressures. Please make sure that the process line pressure is removed prior to service.
6. Please make sure that original parts of Brooks are used when the device requires servicing. Note however that look-alike substitutions and procedures can affect the product's performance and place the save operation of your process at risk. It furthermore may result in fire, electrical hazards or improper operation.

DANISH

VIGTIGE SIKKERHEDSINSTRUKTIONER

Denne instruktion indeholder vigtige oplysninger om sikkerhed og anvendelse af Brooks Thermal Mass Flow Meter/ Controller Series. Instrumentet opfylder (PED) trykudstyrs CE direktivet 97/23/EC. Kontakt de lokale myndigheder for oplysning om nationale og/eller lokale sikkerhedskrav og yderligere krav i forbindelse med installationen.

SIKKERHEDSINSTRUKTIONER

1. Læs alle instruktioner samt faremarkeringer på (1) flowmeteret og (2) i alle relevante sektioner af instruktions- og brugervejledningen før instrumentet tages i brug.
2. ADVARSEL: Anvend ikke dette instrument udover de specifikationer, som er angivet i instruktions- og brugervejledningen. Manglende opmærksomhed på denne advarsel kan resultere i alvorlige personskader og/eller skader på udstyret.
3. Vær sikker på at instrumentet er korrekt tilsluttet elektrisk og mekanisk.
4. ANVENDELSE: (a) Luk langsomt flow ind i systemet. For at undgå trykstød åbnes afspærringsventilen langsomt. (b) Kontroller ind- og udgangstilslutningerne for lækager. Hvis ingen lækager findes, kan systemet bringes op på normalt procestryk.
5. ADVARSEL: Hvis vedligehold af instrumentet ikke sker som anbefalet, er der - i tilfælde af høje tryk - risiko for alvorlige skader på såvel personer som på instrumentet. Sørg derfor for at instrumentet er trykløst, før det afmonteres for service.
6. Vær opmærksom på kun at anvende originale Brooks reservedele, når instrumentet skal vedligeholdes. Bemærk at anvendelse af uoriginale reservedele kan forringe instrumentets specifikationer og dermed øge risikoen for skader. Desuden kan anvendelse af uoriginale reservedele medføre risiko for brand, elektrisk stød eller forringet virkemåde.

NEDERLANDS

BELANGRIJKE VEILIGHEIDSINSTRUCTIES!

Deze appendix bevat belangrijke veiligheidsinstructies voor het gebruik van de Themal Mass Flow Meter/ Controller Series Deze instrumenten vodoen aan de (PED) Pressure Equipment CE Directive 97/23/EC (wet op het vervaardigen en distibueren van drukvaten binnen de Europese lidstaten). De locale authoriteiten kunnen u op de hoogte stellen van de daar geldende additionele en/of locale eisen voor installatie en gebruik.

VEILIGHEIDS INSTRUCTIES

1. Lees voor het in gebruiknemen alle instructies en waarschuwingen op de flowmeter en in de gebruiks-handleiding.
2. WAARSCHUWING: Gebruik dit instrument niet buiten de in de gebruiks-handleiding vastgelegde MAXIMALE GEBRUIKS DRUKKEN. Het niet in acht nemen van deze waarschuwingen kunnen leiden tot persoonlijke verwondingen en/of beschadiging van de meetapparatuur.
3. Overtuig u zelf, vòòr het in gebruik nemen, dat het instrument volgens de geldende voorschriften is ingebouwd in de leiding en aangesloten op het (eventuele) spanningsnetwerk.
4. INGEBRUIK NEMEN: (a) Langzaam opvoeren van de stroom in het systeem. Open de kranen langzaam om een plotselinge golfbeweging van de vloeistofstroom te voorkomen. (b) Controleer het instrument op eventuele lekkage, met name de in- en uitlaat aansluitingen. Als er geen lekkage wordt ontdekt, kan het systeem op bedrijfsdruk worden gebracht.
5. WAARSCHUWING: Nalatig onderhoud van dit instrument kan ernstig persoonlijk letsel en/of beschadiging van de meet apparatuur tot gevolg hebben. Overtuig u zelf ervan dat de procesdruk is afgevoerd alvorens onderhoud aan het instrument te plegen.
6. Overtuig u ervan dat er uitsluitend originele Brooks Instrument onderdelen worden gebruikt voor onderhoud en service aan het instrument. U wordt erop gewezen dat het gebruik van universele onderdelen en voorschriften om daar mee om te gaan, nadelige gevolgen kunnen hebben voor het gebruik van het instrument, en daardoor de juiste weking van uw proces in gevaar kan komen. Zelfs kan het gebruik daarvan resulteren in brandgevaarlijke situaties, electriciteitsgevaar of onjuist functioneren.

SUOMI

TURVAOHJEET

Tämä liite sisältää tärkeitä turva- ja käyttöohjeita Brooks:Thermal Mass Flow Meter / Controller Series Instrumentit kuuluvat CE-direktiiviin (PED) PRESSURE EQUIPMENT CE DIRECTIVE 97/23/EC. Kysy lisää paikallisilta viranomaisilta koskien kansainvälisiä ja/tai paikallisia turvakoodeja sekä muita asennusvaatimuksia.

TURVAOHJEET

1. Kaikki ohjeet ja (1) virtausmittariin kiinnitetyt varoittavat merkinnät sekä (2) manuaalin soveltuvat kohdat on luettava ennen laitteen käyttöönottoa.
2. VAROITUS: Älä käytä tätä instrumenttia yli manuaalissa mainittujen maksimiarvojen. Mikäli tätä varoitusta ei noudateta, voi seurauksena olla vakava henkilövahinko ja/tai laitteen vaurioituminen.
3. Varmista, että mittalaite on oikein asennettu sekä prosessiputkistoon että sähköisesti.
4. KÄYTTÖ: (a) Päästä paineet hitaasti järjestelmään. Avaa putkistossa olevat venttiilit hitaasti, jotta vältyttäisiin paineiskuilta. (b) Tarkista mahdolliset vuodot mittarin prosessiliittimien kohdalta. Mikäli vuotoja ei ole, nosta prosessipaine käyttöpaineeseen.
5. VAROITUS: Mikäli tätä laitetta ei huolleta asianmukaisesti, saattaa korkea käyttöpaine aiheuttaa vakavia henkilövahinkoja ja/tai laitteen rikkoutumisen. On varmistettava, että putkistopaine on poistettu huollon ajaksi.
6. Tulee varmistaa, että käyetään Brooks:in alkuperäisiä varaosia kun laite vaatii huoltoa. Huomaa että korvaavat näköisoasat sekä käsittely voi vaikuttaa laitteen toimintaan sekä saattaa prosessin riskialttiiksi. Lisäksi tämä voisi aiheuttaa palo- tai sähköisen vaaran tai toimintaongelmia.

DEUTSCH

WICHTIGE SICHERHEITSHINWEISE

Dieser Anhang enthält wichtige Hinweise für einen sicheren Betrieb des Ganzmetall-Schwebekörperdurchfluss-messers der Baureihe Thermal Mass Flow Meter / Controller Series von Brooks Instrument . Das Gerät entspricht den gültigen PED-Richtlinien (PRESSURE EQUIPMENT CE DIRECTIVE 97/23/EC). Konsultieren Sie lokale Zulassungsbehörden für nationale und/oder regionale Sicherheitsbestimmungen bzw. weitergehende Installationsvorschriften.

SICHERHEITSHINWEISE

1. Bitte lesen Sie alle gekennzeichneten Sicherheitshinweise/ Warnungen auf (1.) dem Gerät und (2.) alle entsprechenden Kapitel in der dazugehörigen Installations- und Bedienungsanleitung vor dem Betrieb des Gerätes.
03. Bitte stellen Sie sicher, dass das Gerät einwandfrei mit elektrischen und druckbeaufschlagten Leitungen verbunden ist.
4. BETRIEB: (a) Lassen Sie das Gerät zu Beginn langsam durchströmen. Öffnen Sie Ventile langsam, damit Druckstöße verhindert werden. (b) Prüfen Sie den Aufbau am Ein- und Ausgang des Gerätes auf Leckagen. Wenn Sie kein Leck feststellen können, erhöhen Sie langsam den Systemdruck bis der gewünschte Prozessdruck erreicht ist.
5. WARNUNG: Bei unsachgemäßer Wartung des Gerätes geht von diesem aufgrund potentiell hoher Betriebsdrücke ein hohes Sicherheitsrisiko für Personen und Material aus. Bitte vergewissern Sie sich vor Wartungsarbeiten, dass die Leitungen drucklos sind.
6. Verwenden Sie ausschließlich Original-Ersatzteile von Brooks Instrument für die Wartung und Reparatur von Geräten. Verwendung von Fremdfabrikaten oder Nachbildungen kann die Leistung des Gerätes einschränken und die Betriebssicherheit aufheben. Fehlfunktionen und gefährliche Betriebszustände können weitere Folgen sein.

FRANCAIS

INSTRUCTIONS IMPORTANTES DE SECURITE

Cet appendice contient des instructions importantes de sécurité pour l'utilisation du Thermal Mass Flow Meter/ Controller Series. Cet instrument est conforme aux nouvelles directives PED "PRESSURE EQUIPMENT CE DIRECTIVE 97/23/EC".

INSTRUCTIONS

1. Veuillez bien lire toutes les instructions, remarques et avertissements (1) sur l'appareil et (2) dans le manuel d'installation, d'utilisation et d'entretien.
2. AVERTISSEMENTS: Ne pas utiliser cet instrument en dehors des caractéristiques de fonctionnement spécifiées dans le manuel d'instructions. Dans le cas contraire, le personnel risque de se blesser grièvement et/ou d'endommager le matériel.
3. S'assurer que l'appareil est bien relié électriquement et soumis à une pression de travail.
4. OPERATION: (a) Lorsque l'installation du débitmètre dans la canalisation est achevée. La mise en débit du débitmètre doit être exécutée progressivement en ouvrant doucement le vanne de régulation afin d'éviter tout sur débit (b) Vérifier que les raccordements d'entrée et sortie soient parfaitement étanches (sans fuite), puis mettre sous pression de travail.
5. AVERTISSEMENT: Lors d'interventions d'entretien, bien s'assurer que la pression dans la canalisation est proche de zéro. Dans le cas contraire, le personnel risque de se blesser grièvement et/ou d'endommager le matériel.
6. Bien s'assurer que les pièces d'origine Brooks sont utilisées pour des interventions d'entretien. Des pièces de substitution pourraient affecter les performances de l'appareil et engendrer de graves disfonctionnements.

NORSK

VIKTIG SIKKERHETS INSTRUKS

Dette tillegget inneholder viktige sikkerhets og drifts instruksjoner for bruk av Brooks metall rør mengde måler Thermal Mass Flow Meter / Controller Series. Instrumentet tilfredstiller (PED) PRESSURE EQUIPMENT CE DIRECTIVE 97/23/EC. Kontakt lokale myndigheter for nasjonale eller lokale sikkerhetskoder og andre installasjonskrav.

SIKKERHETS INSTRUKS

1. Les alle instruksjoner og sikkerhetsanmerkninger for (1) mengde måleren (Flow meteret) og (2) alle aktuelle seksjoner av instruksjons manualen før bruk av produktet.
2. ADVARSEL: Bruk ikke dette instrumentet utover de spesifikasjonene som er gitt I instruksjons boken. Dersom advarslene ikke følges kan det resultere i alvorlig personskader og/eller ødeleggelse av utstyret.
3. Kontroller at instrumentet er skikkelig koblet både elektrisk og mekanisk.
4. DRIFT: (a) Start forsiktig. Ventilen åpnes langsomt for å unngå strømning sjokk. (b) Kontroller at det ikke er lekkasjer rundt målerens inn- og utløpstilkoblinger. Dersom det ikke er synlige lekkasjer kan ventilen åpnes til fullt operasjonstrykk.
5. ADVARSEL: Dersom utstyret ikke blir riktig vedlikeholdt kan det føre til alvorlige personskader og/eller skade på instrumentet på grunn av potensielle høye trykk. Påse at prosesstrykket er avlastet før utstyret demonteres.
6. Bruk alltid Brooks original deler ved service. Merk at selv om erstatningene ser like ut kan de påvirke produktets virkemåte og gjøre prosessen usikker. Det kan videre føre til brann, elektrisk risiko eller feil virkemåte.

ITALIANO

IMPORTANTI ISTRUZIONI PER LA SICUREZZA

Questa appendice contiene importanti istruzioni sia per la sicurezza che per l'uso corretto degli flussometri metallici della Brooks Instrument della Thermal Mass Flow Meter / Controller Series. Questi strumenti seguono la normativa (PED) Direttiva CE 97/23/EC per gli strumenti in pressione. Consultare le autorità locali per i codici di sicurezza nazionali/internazionali e per ulteriori norme di installazione.

ISTRUZIONI DI SICUREZZA

1. Prima di utilizzare il prodotto leggere attentamente tutte le istruzioni ed I marchi di sicurezza applicati sui flussimetri (1) e Appendici relative delle istruzioni e del manuale operativo (2).
2. ATTENZIONE: Non utilizzare questo strumento oltre I limiti massimi delle specifiche elencate sia nelle istruzioni per l'uso che nel manuale operativo. La mancata osservanza di tali istruzioni potrebbe causare il rischio di lesioni personali e/o al danneggiamento dello strumento stesso.
3. Controllare che lo strumento sia correttamente collegato alle fonti di pressione che a quelle elettriche.
4. ISTRUZIONI OPERATIVE: (a) Lentamente procedere ad aprire il flusso allo strumento. Aprire lentamente le valvole di processo dello strumento per evitare picchi di pressione. (b) Controllare l'assenza di perdite sia sui raccordi di entrata che in quelli di uscita dello strumento. Se non si riscontra alcuna perdita, portare lo strumento alla pressione di esercizio.
5. ATTENZIONE: Se allo strumento non viene fatta regolarmente una corretta manutenzione, alle alte pressioni potrebbero verificarsi lesioni personali e/o danni allo strumento. Assicurarsi che la pressione di processo sia stata tolta laddove si necessiti effettuare una manutenzione.
6. Assicurarsi che siano utilizzate solo parti originali nella manutenzione degli strumenti. Si fa notare che la sostituzione con parti compatibili e la manutenzione effettuata non seguendo le procedure del fornitore, posso provocare alterazioni nelle prestazioni dello strumento ed alterare lo stato di sicurezza delle Vs. linee di processo. Ancor più potrebbe provocare rischi di incendio, rischi elettrici o far risultare errati i processi in corso.

SWEDISH

VIKTIG SÄKERHETSINFORMATION

Denna bilaga innehåller viktig information om säkerhet och handhavande vid installation och användande av Brooks Flödesmätare i Thermal Mass Flow Meter / Controller Series. Instrumentet är i överensstämmande med (PED) PRESSURE EQUIPMENT CE DIRECTIVE 97/23/EC. Kontakta de lokala myndigheterna angående eventuella nationella föreskrifter och ytterligare föreskrifter angående krav på riktig installation.

SÄKERHETS INSTRUKTION

1. Läs alla instruktioner och varningsföreskrifter på (1) flödesmätaren och (2) alla aktuella avsnitt i Instruktion - och handhavande manualen innan produkten tas i drift.
2. VARNING! Använd inte detta instrument utanför de angivna specifikationerna, som anges i Instruktion - och handhavande manualen. Att ej beakta denna varning kan resultera i alvarlig personskada och/eller skada på utrustningen.
3. Vänligen kontrollera att instrumentet är rätt inkopplat elektriskt och mekaniskt med avseende på elektrisk spänning och aktuellt tryck.
4. Vid igångsättning: (a) Släpp långsamt på aktuellt flöde i systemet. Öppna processventiler långsamt för att undvika för höga flöden. (b) Kontrollera om det finns några läckage runt flödesmätarens anslutningar. Om det inte finns något läckage, öka försiktigt till aktuellt arbetstryck.
5. Varning: Om denna utrustning inte servas enligt instruktionsboken kan alvarlig personskada inträffa. Utrustningen kan skadas av för högt tryck. Vänligen kontrollera att processtrycket på mätaren är frånkopplat i samband med service.
6. Vänligen kontrollera att bara BROOKS originaldelar används i samband med service. Observera at delar med motsvarande utseende, men ej originaldelar, kan påverka flödesmätarens funktion och prestanda samt påverkar säkerheten i processen. Det kan även resultera i eldsvåda, elektrisk fara eller felaktig funktion.

ESPANIOL

IMPORTANTES INSTRUCCIONES DE SEGURIDAD

Este apéndice contiene importantes instrucciones de operación y seguridad para el uso de los rotámetros de tubo de vidrio BROOKS de la Thermal Mass Flow Meter / Controller. El instrumento es conforme a la directiva 97/23/CE sobre Equipos a Presión de la Comunidad Europea (PED). Consulte con sus autoridades locales por si existieran normas ó directivas adicionales sobre el uso y/o instalación de dicho tipo de instrumentos.

INSTRUCCIONES DE SEGURIDAD

1. Lease con cuidado todas y cada una de las identificaciones del aparato (1) asi como las secciones del Manual de Inatalación y Operción antes de usar el rotámetro.
2. ATENCION! No operar nunca el instrumento por encima de las especificiones de Máxima Presión de Operación reseñadas en el Manual de Instalación y Operación. El no seguir estas instrucciones puede provocar daños y perjuicios en personas y/ó equipos.
3. Asegurarse de que el instrumento ha sido conectado e instalado correctamente a la fuente de presión y/o eléctrica.
4. OPERACION: (a) Empezar abriendo el caudal cuidadosamente. Abra lentamente las válvulas para evitar puntas de caudal. (b) Comprobar si existen fugas en el caudalímetro y sus conexiones. Si no se encuentran fugas continuar abriendo hasta conseguir las condiciones normales de servicio.
5. ATENCION! Llevar un mantenimiento adecuado con el fín de prevenir y evitar fallos debidos a altas presiones de operación. El no seguir estas instrucciones puede provocar daños y perjuicios en personas y/ó equipos. Despresurizar la línea antes de desmontar el rotámetro.
6. Utilice solo piezas originales BROOKS para el mantenimiento de su rotámetro. El uso de piezas de otros suministradores con apariencia similar puede afectar las prestaciones y la seguridad del equipo. Cualquier cambio indebido puede resultar en una explosión ó operación incorecta.

LIMITED WARRANTY

Seller warrants that the Goods manufactured by Seller will be free from defects in materials or workmanship under normal use and service and that the Software will execute the programming instructions provided by Seller until the expiration of the earlier of twelve (12) months from the date of initial installation or eighteen (18) months from the date of shipment by Seller.
Products purchased by Seller from a third party for resale to Buyer ("Resale Products") shall carry only the warranty extended by the original manufacturer.
All replacements or repairs necessitated by inadequate preventive maintenance, or by normal wear and usage, or by fault of Buyer, or by unsuitable power sources or by attack or deterioration under unsuitable environmental conditions, or by abuse, accident, alteration, misuse, improper installation, modification, repair, storage or handling, or any other cause not the fault of Seller are not covered by this limited warranty, and shall be at Buyer's expense.
Goods repaired and parts replaced during the warranty period shall be in warranty for the remainder of the original warranty period or ninety (90) days, whichever is longer. This limited warranty is the only warranty made by Seller and can be amended only in a writing signed by an authorized representative of Seller.

BROOKS SERVICE AND SUPPORT

Brooks is committed to assuring all of our customers receive the ideal flow solution for their application, along with outstanding service and support to back it up. We operate first class repair facilities located around the world to provide rapid response and support. Each location utilizes primary standard calibration equipment to ensure accuracy and reliability for repairs and recalibration. The primary standard calibration equipment to calibrate our flow products is certified by our local Weights and Measures Authorities and traceable to the relevant International Standards.
Visit www.BrooksInstrument.com to locate the service location nearest to you.

START-UP SERVICE AND IN-SITU CALIBRATION

Brooks Instrument can provide start-up service prior to operation when required.
For some process applications, where ISO-9001 Quality Certification is important, it is mandatory to verify and/or (re)calibrate the products periodically. In many cases this service can be provided under in-situ conditions, and the results will be traceable to the relevant international quality standards.

CUSTOMER SEMINARS AND TRAINING

Brooks Instrument can provide customer seminars and dedicated training to engineers, end users and maintenance persons. Please contact your nearest sales representative for more details.

HELP DESK

In case you need technical assistance:

Americas	☎ 1-888-554-FLOW	
Europe	☎ +(31) 318 549 290	Within Netherlands ☎ 0318 549 290
Asia	☎ +011-81-3-5633-7100	

CE ISO 9001 QUALITY SYSTEM

Due to Brooks Instrument's commitment to continuous improvement of our products, all specifications are subject to change without notice.

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